FINAL

ENVIRONMENTAL ASSESSMENT FOR THE UPDATE AND IMPLEMENTATION OF THE TOTAL FORCE TRAINING MISSION FOR VISITING UNITS (OPERATION SNOWBIRD, MULTI-SERVICE, AND FOREIGN MILITARY SALES) DAVIS-MONTHAN AIR FORCE BASE, ARIZONA

AIR COMBAT COMMAND

April 2015

APPENDIX A
PUBLIC NOTICES AND COMMENTS

Ajo Copper News

Hollister David, Publisher
Gabrielle David, Editor
Michelle Pacheco, Office Manager

P. O. Box 39 • Ajo, Arizona 85321
Phone (520) 387-7688
FAX (520) 387-7505

STATE OF ARIZONA)
) **ss.**
COUNTY OF PIMA)

Hollister David deposes and says that he is the publisher of the *Ajo Copper News*, a weekly newspaper of general circulation and established ıracter, published weekly at Ajo, Pima County, zona, and that

TICE OF AVAILABILITY DRAFT VIRONMENTAL ASSESSMENT FOR THE OPOSED IMPLEMENTATION OF NATIONAL ARD BUREAU'S TRAINING PLAN 60-1 IN PPORT OF THE OPERATION SNOWBIRD ;B), DAVIS-MONTHAN AIR FORCE BASE, IZONA

ɔrrect copy of which is attached to this affidavit, ; published in the said *Ajo Copper News* every ɜk in the newspaper proper and not in a plement for

ɔl. August 1, 2012

ister David, Publisher,
Copper News

ɪrn to and subscribed before me, a Notary Public ɪd for the County of Pima, Arizona, this **1** day of ɪust, 2012.

Notary Public

OFFICIAL SEAL
MICHELLE A. PACHECO
Notary Public - State of Arizona
PIMA COUNTY
My Comm. Expires Feb. 27, 2015

NOTICE OF AVAILABILITY
DRAFT ENVIRONMENTAL ASSESSMENT FOR THE
PROPOSED IMPLEMENTATION OF NATIONAL GUARD BUREAU'S
TRAINING PLAN 60-1 IN SUPPORT OF OPERATION SNOWBIRD (OSB),
DAVIS-MONTHAN AIR FORCE BASE, ARIZONA

This Notice of Availability provides formal notification that the availability of the Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) are available for public review. In order to comply with the National Environmental Policy Act (NEPA) of 1969, the U.S. Air Force and U.S. Army Corps of Engineers, Sacramento District conducted an evaluation of potential environmental impacts associated with the proposed implementation of National Guard Bureau's (NGB) Training Plan 60-1 (TP 60-1) Annex C Addendum (Operation Snowbird Ramp Management Plan) at Davis-Monthan Air Force Base (DMAFB), Arizona. The TP 60-1 would expand pilot training operations conducted by the Air National Guard's (ANG) 162nd Fighter Wing (162 FW), Detachment 1, a tenant unit at DMAFB. Other alternatives currently being considered by the NGB include the No Action Alternative, which entails the continuation of OSB at 2009 levels; addition of other U.S. aircraft at 2002 level of operations; and the addition of U.S. and foreign aircraft at 2002 level of operations. The Draft EA is available at the following local libraries: Eckstrom-Columbus Branch Library, 4350 East 22nd Street, Tucson, AZ, 85711; Quincie Douglas Library, 1585 East 36th Street, Tucson, AZ 85713, and Salazar-Ajo Library, 33 West Plaza Street, Ajo, AZ 85621. It is also available online at:
http://www.dm.af.mil/library/operationsnowbirdenvironmentalassessment.asp.

The 45-day public comment period begins with the publication of this Notice of Availability, and ends on 14 September, 2012. Comments must be submitted in writing to the following address: ATTN: OSB EA COMMENT SUBMITTAL, 355th Fighter Wing Public Affairs, 3180 S. First Street, Davis-Monthan AFB, Arizona 85707.

Published August 1, 2012, Ajo Copper News

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Tucson, A

STATE OF ARIZONA)
COUNTY OF PIMA)

Debbie Capanear, being first says: that she is the Legal A of **TNI PARTNERS,** a Gener and existing under the laws of that it prints and publishes t daily newspaper printed and Tucson, Pima County, State general circulation in said elsewhere, and that the attach

Legal Nc

published correctly in the e Arizona Daily Star on each o wit:

JULY 31, 2012

Debbie Capan

Subscribed and sworn to befor
August, 2012

Lydia Fimbres
Notary Public

LYDIA FIMBRES
Notary Public - Arizona
Pima County
My Comm. Expires Oct 18, 2015

My commission expires

AD NO. 7828699

NOTICE OF AVAILABILITY
DRAFT ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED IMPLEMENTATION OF NATIONAL GUARD BUREAU'S TRAINING PLAN 60-1 IN SUPPORT OF OPERATION SNOWBIRD (OSB), DAVIS-MONTHAN AIR FORCE BASE, ARIZONA

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Publish July 31, 2012 • Arizona Daily Star

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Tucson, Ariz

STATE OF ARIZONA)
COUNTY OF PIMA)

Debbie Capanear, being first d
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Pima County, State of Arizona
circulation in said City, County
and that the attached ad was pr

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Arizona Daily Star on each of
wit:

SEPTEMBER 22, 2014

Debbie Capanea

NOTICE OF AVAILABILITY
DRAFT ENVIRONMENTAL ASSESSMENT FOR THE
UPDATE AND IMPLEMENTATION OF THE
TOTAL FORCE TRAINING MISSION FOR VISITING UNITS
(OPERATION SNOWBIRD, MULTI-SERVICE, AND
FOREIGN MILITARY SALES)
DAVIS-MONTHAN AIR FORCE BASE, ARIZONA

This Notice of Availability provides formal notification that the Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) are available for public review. In compliance with the National Environmental Policy Act (NEPA) of 1969, the U.S. Air Force, Air Combat Command (ACC) and U.S. Army Corps of Engineers, Sacramento District conducted an evaluation of potential environmental impacts associated with the proposed update and implementation of Total Force Training Mission for Visiting Units at Davis-Monthan Air Force Base (DMAFB), Arizona. This is a revision of the July 2012 Draft EA which evaluated the proposed implementation of the Training Plan 60-1 Annex C Addendum (Operation Snowbird Ramp Management Plan) to support training operations conducted by the Air National Guard's 162nd Fighter Wing, Detachment 1 at DMAFB. ACC revised the 2012 Draft EA to more accurately describe the visiting unit flight operations (i.e., units other than those based at DMAFB) that occur at DMAFB and assess their potential impacts. Alternatives evaluated in this revised EA include the No Action Alternative, which would maintain the number of visiting units' annual sorties to the 2009 levels of 1,408; the Preferred Alternative, which would increase the number of sorties flown by visiting units to 2,326 and Alternative 2, which would increase the annual sorties to 2,134. The Draft EA is available at the following local libraries: Eckstrom-Columbus Branch Library, 4350 East 22nd Street, Tucson, AZ, 85711, Quincie Douglas Library, 1585 East 36th Street, Tucson, AZ 85713; Himmel Park Branch Library, 1035 N Treat Avenue, Tucson, AZ 85716; University of Arizona Library, 1510 East University Boulevard Tucson, AZ 85721; Venito Garcia Library & Archives, P.O. Box 837, Sells, AZ 85634; Pascua Yaqui Tribe - Public Library, 7418 South Camino Cocoim, Tucson, AZ 85757; and Salazar-Ajo Library, 33 West Plaza Street, Ajo, AZ 85621. It is also available online at: http://www.dm.af.mil/library/tftea.asp.

The 30-day public comment period begins with the publication of this Notice of Availability, and ends on 23 October 2014. Comments must be submitted in writing to the following address: ATTN: TFT EA COMMENT SUBMITTAL, 355th Fighter Wing Public Affairs, 3405 S. Fifth Street, Suite 1062, Davis-Monthan AFB, Arizona or via e-mail at 355fw.pa.comment@us.af.mil, using the subject line: TFT EA Comment Submittal.

Publish September 22, 2014 • Arizona Daily Star

Subscribed and sworn to before me this 30 day of
September, 2014

Lydia Lumbre
Notary Public

My commission expires __________

AD NO. 8280484

ARIZONA DAILY

Tucson, Ariz

STATE OF ARIZONA)
COUNTY OF PIMA)

Debbie Capanear, being first du says: that she is the Advertising **PARTNERS,** a General Partr existing under the laws of the St it prints and publishes the Ariz newspaper printed and publishe Pima County, State of Arizona circulation in said City, County and that the attached ad was pr

Legal Noti

published correctly in the en Arizona Daily Star on each of wit:

AVISO DE DISPONIBILIDAD
BORRADOR DE LA EVALUACIÓN AMBIENTAL PARA EL ACTUALIZACIÓN E IMPLEMENTACIÓN DE LA MISIÓN DE ENTRENAMIENTO DE FUERZA TOTAL PARA GRUPOS MILITARES VISITANTE (OPERACIÓN SNOWBIRD, MULTISERVICIOS, Y VENTAS MILITARES EXTRANJERAS)
DAVIS-MONTHAN AIR FORCE BASE, ARIZONA

Este aviso de disponibilidad da notificación formal que lo Borrador de Evaluación Ambiental (EA) y el Borrador del Recomendaciones de No Impacto Significativo (FONSI) están disponibles para revisión pública. Para cumplir con la ley Ambiental de Política Nacional (NEPA) de 1969, el Air Combat Command (ACC) de la U.S. Air Force y U.S. Army Corps of Engineers, Sacramento District, realizó una evaluación de los impactos ambientales potenciales asociados con la actualización propuesta e implementación de la Misión de Entrenamiento de Fuerza Total para Grupos Militares Visitante en Davis-Monthan Air Force Base (DMAFB), Arizona. Este es un EA borrador revisado por el EA borrador del julio de 2012 que evaluó la implementación propuesta del Plan de Entrenamiento 60-1 Annex C Addendum (Operation Snowbird Ramp Management Plan) para apoyar operaciones de entrenamiento realizado por el 162nd Fighter Wing del Air National Guard Detatchment 1 a DMAFB. El ACC ha decidido a revisar el 2012 EA borrador para describir con mayor precisión los grupos militares visitantes (es decir, los unidades que no sean aquellos basados en DMAFB), sus operaciones de vuelo que se producen en el DMAFB y evaluación de los impactos potenciales. Evaluaciones alternativos en esta EA revisado incluyen la Alternativa de No Acción, que sería mantener el número de vuelos anuales de las grupos militares visitantes a los niveles de 2009 (1;408 salidas); la Alternativa Preferida, que aumentaría el número de incursiones volado por grupos militares visitante a 2,326; y la Alternativa 2, lo que aumentaría los vuelos a 2,134 por año. El Borrador EA está disponible en las siguientes bibliotecas locales: Eckstrom-Columbus Branch Library, 4350 East 22nd Street, Tucson, AZ, 85711, Quincie Douglas Library, 1585 East 36th Street, Tucson, AZ 85713; Himmel Park Branch Library, 1035 N Treat Avenue, Tucson, AZ 85716; University of Arizona Library, 1510 East University Boulevard Tucson, AZ 85721; Venito Garcia Library & Archives, P.O. Box 837, Sells, AZ 85634; Pascua Yaqui Tribe - Public Library, 7418 South Camino Cocoim, Tucson, AZ 85757; y Salazar-Ajo Library, 33 West Plaza Street, Ajo, AZ 85621. También está disponible a la internet a: http://www.dm.af.mil/library/tftea.asp.

El período de comentario público de 30 días comienza con la publicación de este Aviso de Disponibilidad y finaliza el 23 de Octobrie de 2014. Comentarios escritos deben ser presentadas por a la siguiente dirección: ATTN: TFT EA COMMENT SUBMITTAL, 355th Fighter Wing Public Affairs, 3405 S. Fifth Street, Suite 1062, Davis-Monthan AFB, Arizona 85707, o a través de e-mail to 355fw.pa.comment@us.af.mil.

Publish September 22, 2014 • Arizona Daily Star

SEPTEMBER 22, 2014

Debbie Capanear

Subscribed and sworn to before me this 30 day of September, 2014

Lydia Fimbres
Notary Public

LYDIA FIMBRES
Notary Public - Arizona
Pima County
My Comm. Expires Oct 18, 2015

My commission expires

AD NO. 8280285

SUBSTANTIVE COMMENTS ON
2014 REVISED DRAFT EA

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Wednesday, September 24, 2014 1:24 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: TFT EA Comment Submittal
Attachments: TFT EA Comment Submittal.pdf

-----Original Message-----
From: Anna Lands [mailto:healing@rnsmte.com]
Sent: Tuesday, September 23, 2014 7:09 PM
To: 355 FW/PA Comments
Subject: TFT EA Comment Submittal

Dear Folks - Attached is my comment regarding the increase of flights at Davis-Monthan Airbase in Tucson.

Anna Lands

TFT EA Comment Submittal

355th Fighter Wing Public Affairs

3405 Fifth Street

Davis-Monthan Air Force Base, Arizona 85707

September 23, 2014

To Whom It May Concern:

This comment is in regard to the proposed increase in flights at Davis-Monthan. My concern is with any flights to the east of Davis-Monthan over the Lower San Pedro River Valley and the community that extends along it. There have been alarming events involving low-flying aircraft (helicopters, C-130's, and a small jet airplane) which motivate this concern. Davis-Monthan Public Relations Office has been informed of these and other events.

My request is this: that **aircraft of any kind maintain an elevation of at least 400 feet while flying over the riparian and residential areas.** Residences and businesses extend two to four miles on either side of this part of the San Pedro River. The entire San Pedro River Valley is the last remaining major migration corridor in the desert southwest.

Further information is at http://cascabelworkinggroup.org/. We established these pages in response to the proposed SunZia Transmission Project, and the information remains current and accurate.

Sincerely,

Anna Lands

6520 Cascabel Road

Benson, Arizona 85602

520-212-9853

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, September 29, 2014 11:36 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: ATTN: TFT EA COMMENT SUBMITTAL

From: Ellis & Tatyana Spiegel [mailto:ellis_tatyana@yahoo.com]
Sent: Friday, September 26, 2014 11:07 PM
To: 355 FW/PA Comments
Subject: ATTN: TFT EA COMMENT SUBMITTAL

According ot the World Health Organization (WHO), "for community noise recommend less than 30 A-weighted decibels (dB(A)) in bedrooms during the night for a sleep of good quality... The WHO guidelines for night noise recommend **less than 40 dB(A) of annual average (Lnight) outside of bedrooms to prevent adverse health effects from night noise.**"

How can you say that noise over 60 dB is of no impact and no concern?
"Over 60 dB" means anything above 60 dB and not anywhere near safe 30-40 dB.
I suggest you **RECONSIDER AT LEAST NIGHT FLIGHTS.**
Unless there is a real emergency - NO NIGHT FLIGHTS.
PEOPLE NEED THEIR SLEEP TO BE WELL.

Tatyana Spiegel,
Tucson resident

WHO/Europe | Data and statistics

WHO/Europe | Data and statistics
World Health Organization Regional Office for Europe
View on www.euro.who.int Preview by Yahoo

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, October 09, 2014 5:40 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Comments on Draft EA for Total Force Training Mission
Attachments: SCA-COPIER-14100909331.pdf

Importance: High

-----Original Message-----
From: Maura Kwiatkowski [mailto:Maura.Kwiatkowski@pima.gov]
Sent: Thursday, October 09, 2014 10:10 AM
To: 355 FW/PA Comments
Subject: Comments on Draft EA for Total Force Training Mission
Importance: High

Good morning.

Please find enclosed Pima County's comments on this Draft Environmental Assessment.

Could you please reply to this message to confirm receipt of these comments?

Thank you,

Maura Kwiatkowski

Maura J. Kwiatkowski

Chief Administrative Assistant to

Pima County Administrator Chuck Huckelberry

130 W. Congress Street, Floor 10

Tucson, Arizona 85701
рнл‐тнп‐урут

THE SEAL OF PIMA COUNTY ARIZONA

BOARD OF SUPERVISORS

PIMA COUNTY GOVERNMENTAL CENTER
130 W. CONGRESS, FLOOR 11, TUCSON, AZ 85701-1317
(520) 724-8126 FAX (520) 884-1152

October 9, 2014

United States Air Force
ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis-Monthan AFB, Arizona 85707

Re: **Federal Environmental Assessment for Davis-Monthan Air Force Base's Total Force Training Mission**

The US Air Force began a 30-day public comment period on September 24, 2014 for a revised draft of the Total Force Training Environmental Assessment (EA), a federally mandated analysis of potential environmental impacts and options related to specific flight exercises, training and other activities conducted at Davis-Monthan Air Force Base. The Total Force Training operations, which include Operation Snowbird, involve the training of visiting airmen from allied foreign nations and other units from different branches of the US military, including active duty, National Guard and reserve units. The host unit for the training is the 162nd Fighter Wing of the Arizona Air National Guard, which has supported the program since 1975. Air operations are also supported by the Air Force's 355th Fighter Wing based at Davis-Monthan.

In the 39 years these training missions have occurred, thousands of pilots and other military personnel have traveled to Davis-Monthan and received high-level instruction that supports critical aspects of US military and allied nations' defense preparations. The program is unique to our area and is made possible by our ideal climate for air operations, open desert and the presence of facilities such as Davis-Monthan, the 162nd Fighter Wing at Tucson International Airport and a number of nearby Military Operation Areas, including the Barry M. Goldwater Gunnery Range west of Ajo. The Air Force considers Operation Snowbird and the Total Force Training operations critical to the nation's military readiness, and the year-round training has served as important preparation for the military's most recent engagements in Afghanistan and Iraq.

Pima County has long supported Davis-Monthan in its mission. In March, the Board of Supervisors approved a resolution supporting the Base, including "any new missions, flying or

otherwise. Pima County is an active participant in the DM-50, the Southern Arizona Defense Alliance and other organizations that support Davis-Monthan. Pima County voters approved spending $10 million, which was used to acquire land and protect the Base's flight corridors and prevent urban encroachment. Pima County has provided millions of dollars in infrastructure for Davis-Monthan since its inception as an active military base in 1941.
The EA finding of no significant impact for both of the alternatives is important to note. The alternative with the most sorties and potential impact (Alternative 1) included the following summary of environmental consequences:

> *"No impacts were identified regarding land use, climate, geology, soils, water quality and supply, wetlands, fish and wildlife populations, transportation and public services. Insignificant impacts would be incurred on noise, air quality, socioeconomics (including property values), public safety and cultural resources...The Arizona State Historic Preservation Office has concurred with the Air Force's determination of no adverse effects on historic properties, under Section 106 of the National Historic Preservation Act. However, on-going Section 106 consultation with Native American Tribes is continuing. Section 106 consultation regarding cultural resources has been completed. The No Action Alternative would result in no change to existing conditions."*

The EA, as noted, does determine that there are impacts related to noise, air quality, socioeconomics, public safety and cultural resources; but all were determined to be insignificant. To better understand these impacts on the health, safety and welfare of Pima County residents, and to provide objective information to the Board of Supervisors and the community prior to the close of the public comment period on October 23, 2014, I have directed County staff was directed to evaluate the EA. Pima County has expertise in several of the areas included in the analysis and concurs with the findings in the following areas:

1. Noise. This is an important factor to the community. The citizens of Pima County addressed this issue, as well as safety, in 2004 by approving a $10 million bond package to acquire land and other properties in the departure corridor. That $10 million was spent on a total of 15 properties resulting in the removal of over 460 acres of land destined for high density development. In preparation for a Bond Election in 2014, Pima County proposed another $10 million Noise Attenuation Bond Program for residences impacted by operational activities at the Base. Some objected to this proposal, and it was withdrawn. With community consensus, however, it could be added to a future bond program proposal.

2. Air Quality. The Pima County Department of Environmental Quality reviewed the data and concurred with the findings saying *"Since the projected air quality impacts are minimal, even a large margin of error in the modeling would still show insignificant levels of emissions increases from the project."*

3. Socioeconomics. Pima County information was listed as the source for some of the analysis in this section of the report. Our economist has reviewed the findings and found that the housing value trends presented in the report are consistent with the trends we have seen over the past few years. His comment was "Demographic and socioeconomic data and conclusions appear reasonable. I have not vetted each number appearing in the EA, but the numbers listed and conclusions reached from those numbers are consistent with my knowledge of the County and the impact areas." The County's values lag the EA values by a year, which can be explained by the difference in the Property Tax Valuation Year and the values as of a specific Calendar Year.

   The methodology of analysis can also influence the outcome using similar data. Recognizing that home values in this area are impacted by a number of factors, including age of the structure, construction and demographics, as well as their proximity to the flight path, our conclusion is that the trends presented in the EA are reasonable and consistent with general conditions in the years cited. This would still not modify the conclusion in the EA that there is no disproportional impact on minority or low-income populations compared to the No Action Alternative.

4. Cultural Resources. The County has long been a staunch advocate for and investor in the preservation of the many cultural resources in our region. We are pleased the Section 106 consultation was completed as a part of the EA. We work closely with the State Historic Preservation Office and have no opinions or concerns that would alter the conclusions reached in this section of the report.

Pima County has many roles in the community. The County has a responsibility to review the impact of projects like the Total Force Training Mission on our citizens, our environment, and our economic wellbeing and take a position where the impact is inappropriate. This version of the Environmental Assessment is much more thorough in its documentation of positive and negative impacts and provides a strong basis for the conclusions reached. We concur with the conclusions in the report and encourage the initiation of the Total Force Training Mission at Davis-Monthan Air Force Base.

Sincerely,

Sharon Bronson

Ramón Valadez

C. Huckelberry

Sharon Bronson, Chair
Board of Supervisors

Ramón Valadez, Member
Board of Supervisors

C.H. Huckelberry
County Administrator

14224 S. Camino Burgos
Sahuarita, AZ 85629

TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth St.
Davis-Monthan AFB, AZ 85707

Dear Sir or Madame:

Re: Request for Economic-Impact Statement (EIS) for D-M Flight-Training

We request that an EIS be performed as soon as possible to not delay a boost in flight-training at Davis-Monthan Air Force Base.

We believe an EIS is needed because it was not done originally, in accord with the latest draft (1); total training flights could double; "several different types of aircraft, not mentioned in the original draft, including louder jets such as the F-22 Raptor and the AV-8B Harrier", as well as Britain's GR4 Tornado that has resulted in complaints; the original draft relied on average, not peak, noise levels; did not include noise assessments of the next-generation F-35 Lightning II stealth fighter; the noise zone from aircraft operations was expanded; and added homes would be located where noise levels reach 65 to 69 decibels.

Sincerely yours,

Frederick A. Keller, Jr.

(1) "Air Force issues revised study of D-M flight-training boost", Arizona Daily Star, pg. A1, 23Sept.2014.

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, October 23, 2014 10:23 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: DEA of Total Force Training Mission is Greatly Flawed

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From: Lee Stanfield [mailto:simplee@cox.net]
Sent: Thursday, October 23, 2014 2:26 AM
To: 355 FW/PA Comments
Subject: DEA of Total Force Training Mission is Greatly Flawed

Environmental Assessments are supposed to include only scientifically sound, appropriate, pertinent methods of determining the facts. However, this DEA's “FONSI" was based on the use of completely inappropriate tools for measuring the impact of increased noise and increased risk. It was not scientifically conducted, and its conclusions are flagrantly false.

Using the DNL to measure the impact of short bursts of extreme noise from military overflights, is so inadequate and inappropriate, that it would be laughable (except that this is a very serious matter for the residents affected).

Using inappropriate tools such as the DNL for noise measurement, insufficiently enlarging the noise contours, and failure to appropriately measure the cumulative noise impact, are three of the ways this DEA failed to adequately address the effects on the lives of central Tucson residents.

Specifically, it did not adequately address effects on:

* physical health (esp. hearing, blood pressure, and other cardiovascular issues)
* emotional health
* property values
* local businesses (such as restaurants and hotels, resorts, and golf courses)
* schools
* medical clinics
* hospitals
* places of worship
* parks, the desert museum, and the zoo,
* tourism (which contributes almost twice as much to Tucson’s economy as D-M)
* the quality of life of central Tucson residents, in general

In addition, the recent flooding of the local media with the false conclusions of the SADA survey (which was so highly biased that it was, in fact, nothing more than a piece of propaganda) is being done in order to mislead the public and the AF Pentagon officials, into believeing that even those residents who live near D-M and TIA are strongly supportive of the AF plans to double the fequency of military overflights and to bring in louder and riskier aircraft.

This conclusion is... in fact… entirely false. The SADA included all of Southern Arizona and all Southern Arizona military bases in its purvue, while offering no evidence at all that any of its participants reside inside the city limits of Tucson, let alone anywhere near the flight paths for D-M or ANG out of TIA.

Instead, the SADA makes the claim that they surveyed a small subset of 103 residents who, they claim live near D-M or TIA. But suspiciously, the SADA has not provided any major cross streets or zip codes, in evidence that these 103 participants actually live where the SADA claims they live.

It is suspicious that this subset was treated so differently from the rest of the participants. Unlike the others, the survey was not emailed to them or sent to their home. Instead, we are told that there was an "intercept-based" survey of these participants at businesses near D-M and TIA, where they were customers.

Adding to the suspicion…. when the SADA survey supporters were questioned as to where these 103 participants live (such as zip codes or major cross streets near them) the answer given was that they would not disclose the identity or "Respondent-identifiable information"on ethical grounds. However, they had published the zip codes for participants living in areas outside of the City of Tucson….. so that was ethical, but it would be unethical to publish or give out the zip codes of participants they claim live near D-M or TIA???

So the actual question, which did not ask for any "Respondent-identifiable information" in the first place, was never answered.

But even without the suspicious aspects mentioned in the previous paragraphs, the wording of the SADA rendered it nothing more than a blatant piece of propaganda. For instance, participants were given no opportunity to object to any military operations (such as overflights) without having to oppose the existence of all military bases in Southern Arizona.

As for the wording of questions regarding the F-35, it was very careful not to ask if anyone was in favor of the F-35 flying over their community….. only if they were in favor of the F-35 flying over Southern Arizona. What a blatant attempt at skewing results! Of course almost no one opposed F-35s flying over Southern Arizona, because most people envision that it will be flying over the enormous areas of unpopulated desert in Southern Arizona.

But sadly, the AF wants us to let them wreck our Tucson economy with this deafening aircraft, rather than spend a penny on building a base out in the desert, or adapting a base already in a sparsely populated desert area, such as Gila Bend.

In addition, including residents from the entire region of Southern Arizona as participants, effectively and significantly watered down any responses of the few participants who lived in the City of Tucson…. if there were any.

One can't help but see the irony of using this obviously flawed "survey" to support an equally flawed "DEA". They are a matched set. The way the SADA was conducted and its unfounded conclusions, are indicative of the way this DEA was conducted. They are both nothing more than smoke and mirrors propaganda being used to shove whatever the Air Force wants to fly, down the throats of Tucson residents!!

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, October 23, 2014 3:39 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: FONSI Inadequate...Remember Hampton Roads Lawsuit???

-----Original Message-----
From: jeanblu@aol.com [mailto:jeanblu@aol.com]
Sent: Thursday, October 23, 2014 1:28 PM
To: 355 FW/PA Comments
Subject: FONSI Inadequate...Remember Hampton Roads Lawsuit???

Dear US Air Force:

Wait just a minute...Trying to pull a FAST ONE will NOT work!!!!!!   There are significant differences. Please correct your position.

* The DEA uses Day-Night Level noise averaging (DNL) as its sole method of noise analysis. DNL is a long-term average, and does not adequately represent the very loud short-duration noise of aircraft passing over our homes. The DEA must use additional methods of noise analysis, as described in Department of Defense publications.

* The DEA's analysis of property values is deficient. The DEA must use accepted methods of property valuation, and it must incorporate the results of the many studies which correlate property values to aircraft noise.

* The DEA's analysis fails to adequately consider the total cumulative impacts of all of DM's flight operations. An increase in Total Force Training operations will result in an incremental increase in DM's impact, and this incremental increase must be analyzed in light of the impact of all other operations. In other words, there is a set level of noise that is acceptable, and the AF must take into account all existing noise (not just noise from the proposed increased overflights). So if adding the proposed increase to the already existing noise, causes the maximum level to be surpassed, then that must be taken into account.

Jean Saysani

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, October 23, 2014 12:25 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: FWGov Ltr to DM Ref: Snownbird EA (UNCLASSIFIED)
Attachments: 20141022170041419.pdf

-----Original Message-----
From: Johnson, Gabriel D MAJ USAF NG AZANG (US)
[mailto:gabriel.d.johnson10.mil@mail.mil]
Sent: Thursday, October 23, 2014 10:06 AM
To: OSBORNE, CASEY R Capt USAF ACC 355 FW/PA
Cc: 355 FW/PA Comments; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: FW: FWGov Ltr to DM Ref: Snownbird EA (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Capt Osborne
I am submitting the attached letter on behalf of Governor Jan Brewer for inclusion in the Total Force Training Draft EA. Would you please add this to the review of public comments and the official record?

//SIGNED//
GABE JOHNSON, Maj, AZ ANG
State Public Affairs Officer
Arizona National Guard
Office: 602-267-2619 (DSN 853)
Mobile: 602-206-7659
Visit us at:
https://dema.az.gov

-----Original Message-----
From: Gutierrez, Jason P CAPT USAF NG AZANG (US)
Sent: Thursday, October 23, 2014 9:59 AM
To: Johnson, Gabriel D MAJ USAF NG AZANG (US)
Subject: FW: FWGov Ltr to DM Ref: Snownbird EA

Sir,
Per our discussion.
Thank you!
Jason

//SIGNED//
JASON P. GUTIERREZ, Capt, AZANG
Executive Officer
Comm: (602)267-2616 DSN: 8532616 BB: (602)616-1580

-----Original Message-----
From: 8thRicoh@azgov.gov [mailto:8thRicoh@azgov.gov]
Sent: Wednesday, October 22, 2014 3:01 PM
To: Trista Guzman; Joseph Cuffari
Subject:

This E-mail was sent from "8thFloorRicoh" (Aficio MP C6000).

Scan Date: 10.22.2014 17:00:41 (-0500)
Queries to: 8thRicoh@azgov.gov

Classification: UNCLASSIFIED
Caveats: NONE

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, October 27, 2014 11:03 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG

From: Carol Stoner [mailto:c_stone77@msn.com]
Sent: Friday, October 24, 2014 10:34 PM
To: 355 FW/PA Comments
Subject: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG

My comment submittal:

1. DNL is a long-term average, and does not adequately represent the very loud short-duration noise of aircraft passing over our homes.
The ea must use additional methods of noise analysis, **as described in Department of Defense publications**. It's current analysis is deficient.

2. They do not address how the constant noise impacts an individual's life, making it unbearable, diminishing a person's quality of life to zero. We have **one life to live** and we have a right to the best quality of life that can be offered. The Air Force can't unilaterally subject citizens to constant aircraft noise, it is a **violation of the constitution. No aircraft existed when the constitution was drafted and the Air Force has unilaterally made up their own rules.** Aircraft noise can and should be moved to another location away from the city, homes, residences, and businesses.

2. The EA must use accepted methods of property valuation, and it must incorporate the results of the many studies which correlate property values to aircraft, it's current evaluation is deficient.

3. An increase in TFT operations will result in an incremental increase in DM's total impacts, and this incremental increase must be analyzed in light of the impacts of all other operations. It's current analysis of cumulative impacts is deficient.

I STRONGLY OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG.

Carol Stoner
65 N Cheesebrush Ave
Tucson, Az 85748
520-298-9741
c_stone77@,msn.com

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, October 27, 2014 11:04 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG

From: Carol Stoner [mailto:c_stone77@msn.com]
Sent: Friday, October 24, 2014 10:41 PM
To: 355 FW/PA Comments
Subject: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG

My comment submittal:

1. The DEA's analysis fails to adequately consider the total cumulative impacts of all of DM's flight operations. An increase in Total Force Training operations will result in an incremental increase in DM's impact, and this incremental increase must be analyzed in light of the impact of all other operations. In other words, there is a set level of noise that is acceptable, and the AF must take into account all existing noise (not just noise from the proposed increased overflights). So if adding the proposed increase to the already existing noise, causes the maximum level to be surpassed, then that must be taken into account.

The EA's analysis of cumulative impacts is deficient. It fails to adequately consider the total impacts of all of DM's flight operations.

Carol Stoner
65 N Cheesebrush Ave
Tucson, Az 85748
520-298-9741
c_stone77@msn.com

From:	355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent:	Friday, October 24, 2014 4:21 PM
To:	CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc:	FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject:	2014 TFT COMMENTS FW: Public Comment by Rep. Ron Barber
Attachments:	image001.jpg; image002.png; image003.png; image004.png; image005.jpg; 2014.10.24 Public Comment on Total Force Training Mission.pdf

-----Original Message-----
From: Wilson-Simerman, Jeremy [mailto:Jeremy.Wilson-Simerman@mail.house.gov]

Sent: Friday, October 24, 2014 2:18 PM
To: 355 FW/PA Comments
Subject: Public Comment by Rep. Ron Barber

Good Afternoon:

Please find attached as a PDF the public comment by Rep. Ron Barber.

Please contact me should you have any questions or concerns.

Thank you,

Jeremy Wilson-Simerman

Jeremy Wilson-Simerman

Legislative Assistant

Rep. Ron Barber (AZ-02)

202-225-2542

cid:image005.jpg@01CDFE0F.A90787E0cid:image006.png@01CDFE0F.A90787E0
<http://www.facebook.com/#!/pages/Rep-Ron-Barber/244907165625305>
cid:image007.png@01CDFE0F.A90787E0 <https://twitter.com/#!/RepRonBarber>
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From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, October 27, 2014 11:06 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG/TUCSON, AZ

From: Carol Stoner [mailto:c_stone77@msn.com]
Sent: Saturday, October 25, 2014 2:31 AM
To: 355 FW/PA Comments
Cc: kathleen.ferguson@pentagon.af.mil; Welsh, Mark A III Gen MIL USAF AF/CC; secaf.office@mail.mil; WHALEY, TONI J Maj USAF AETC AETC/PA; safiei.workflow@pentagon.af.mil; PITTMAN, HEATHER F CIV USAF HAF U S AIR FORCE HQ/IEN; ACC/CC Commander; saf.ig; 355 FW/PA 355th FW Public Affairs; 355 FW/CV 355th FW Vice Commander; RAWLS, MICHAEL T Col USAF AWC AFELM ARMY WAR COL EL/Carlisle Barracks; SMITH, BRUCE M Col USAF ACC 12 AF/CV; WOLTERS, TOD D Lt Gen USAF ACC 12 AF/CC; Paul Cunningham; citymanager@tucsonaz.gov; Mayor1 Mayor1; steve.kozachik@tucsonaz.go; Karin.Uhlich@tucsonaz.gov; Richard.Fimbres@tucsonaz.gov; Regina.Romero@tucsonaz.gov; shirley.scott@tucsonaz.gov; CHH@pima.go; District3@pima.gov; ramon.valadez@pima.gov; District1@pima.gov; District4@pima.gov; 162fw.cc@ang.af.mil; stanley.clark@pentagon.af.mil
Subject: I OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG/TUCSON, AZ

My comment submittal:

1. DNL is a long-term average, and does not adequately represent the very loud short-duration noise of aircraft passing over our homes.
The ea must use additional methods of noise analysis, **as described in Department of Defense publications**. It's current analysis is deficient.

2. They do not address how the constant noise impacts an individual's life, making it unbearable, diminishing a person's quality of life to zero. We have **one life to live** and we have a constitutional right to the best quality of life that can be offered. The Air Force can't unilaterally subject citizens to constant aircraft noise, it is a **violation of the constitution. No aircraft existed when the constitution was drafted and the Air Force has unilaterally made up their own rules.** Aircraft noise can and should be moved to another location away from the city, homes, residences, churches, and businesses.

3. The EA must use accepted methods of property valuation, and it must incorporate the results of the many studies which correlate property values to aircraft, it's current evaluation is deficient.

4. An increase in TFT operations will result in an incremental increase in DM's total impacts, and this incremental increase must be analyzed in light of the impacts of all other operations. It's current analysis of cumulative impacts is deficient.

5. The DEA's analysis fails to adequately consider the total cumulative impacts of all of DM's flight operations. An increase in Total Force Training operations will result in an incremental increase in DM's impact, and this incremental increase must be analyzed in light of the impact of all other operations. In other words, there is a set level of noise that is acceptable, and the AF must take into account all existing noise (not just noise from the proposed increased overflights). So if adding the proposed increase to the already existing noise, causes the maximum level to be surpassed, then that must be taken into account.

The EA's analysis of cumulative impacts is deficient. It fails to adequately consider the total impacts of all of DM's flight operations.

6. The use of 2009 as a baseline for this DEA, is a glaring flaw. It is obviously an attempt to ignore the cumulative effects of all DM flight operations, which is actually a requirement for any EA. Of the three components of Total Force Training, the Air Force has never assessed impacts of either the Multi-Service program or the Foreign Military Sales Program, and has not assessed the Snowbird program since 1978. By analyzing the three programs only from the 2009 baseline forward, the TFT DEA is attempting to avoid there ever being any analysis of impacts due to the operations that were established between 1978 and 2009. This is one reason a careful assessment of cumulative impacts is crucial.

The 2009 baseline is in defiance of the requirements, and that the use of that there must be a very careful assessment of all cumulative impacts…. not just those since 2009.

I STRONGLY OPPOSE ANY INCREASE IN OVERFLIGHTS AT DM/ANG.

Carol Stoner
65 N Cheesebrush Ave
Tucson, Az 85748
520-298-9741
c_stone77@,msn.com

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Wednesday, November 05, 2014 8:46 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Citizen Comment regarding Tucson Environmental Assessment 2014

From: Kathleen Williamson, Esq. [mailto:williamson@williamsonandyoung.com]
Sent: Wednesday, November 05, 2014 12:46 AM
To: 355 FW/PA Comments
Subject: Citizen Comment regarding Tucson Environmental Assessment 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

via: 355fw.pa.comment@us.af.mil

Re: Increased military flights over Central Tucson

To Whom It May Concern:

I strongly protest the AF plan to increase military flights, noise, frequency, or range within urban or central Tucson, Arizona. I object to the recent AF EA FONSI. I have been a resident, tax-payer, property owner, business owner, graduate student, active volunteer, lawyer, scholar, and musician in Central Tucson since 1985. I lived under the DM flight path from 1991 to 2011.

I have lived in adjacent urban areas at other times and been subjected to DM and ANG flights in those areas as well. I also attended law school and did my PhD at the University of Arizona where we regularly had to stop discussions and lectures to wait for military flights overhead to stop drowning out our (and the professors') voices.

The frequency and noise level is already detrimental. Increasing it to any degree will have a negative impact on me as well as the community. We already suffer from the DM activities here and the residential noise abatement programs do not protect any more than a tiny fraction of people who can't stay inside their padded houses all the time to avoid jet noise. We enjoy the outdoors here. We want clean air and quiet enjoyment of our homes and curtilage, churches, school yards, parks, and avenues. We have already experienced several jet crashes fatal to civilians in Central Tucson. Increasing single engine flights over our most populated areas is profoundly reckless. It will be significantly detrimental to our university and student residential areas, as well as all the lovely historic and tourist destinations in Central Tucson.

The proposed additional flight training not only means more noise; it means more air pollution, more jet-generated heat added to our already baking heat island, more danger to people under the already risky single-engine jets being piloted by trainees within a thousand feet over our homes, it means more water sucked out of our increasingly limited wells, and more jet fuel pollution being dumped into our earth and endangered aquifers. Davis-Monthan has already been a superfund site, due to its previous pollution of our ground water, which required wells to be shut down.

WE LIVE HERE. WE BREATH HERE. WE MEDITATE HERE. WE DRINK OUR WATER HERE. WE CHAT IN THE PARKS AND PLAY GUITARS UNDER OUR RAMADAS. WE WALK OUR DOGS HERE. WE REBUILD OUR HOMES HERE. WE GROW OUR GARDENS HERE. WE EDUCATE OUR CHILDREN HERE AND TRY TO KEEP OUR COMMUNITY SAFE AND CLEAN. YOUR JETS ARE TRAINING OVER A HISTORIC AND DENSELY POPULATED PART OF OUR URBAN COMMUNITY. IT'S ALREADY BAD ENOUGH. DO NOT INCREASE IT.

Furthermore, the current Air Force controlled EA, which finds that there will be "no significant impact" from "greatly increasing" military training over Central Tucson, is biased and erroneous on many fronts and is insufficient. An objective and reliable EIS must be conducted here before the Air Force makes its decisions about increasing military jets over our community. A SADA survey that has been presented to you is a faulty and rigged survey by a minority who serve limited business interests in Tucson. The SADA survey was rigged; it did not select participants objectively, randomly and, most importantly, it avoided asking those directly impacted by the flights. A recent survey conducted by Tucson Forward, a citizens' nonprofit organization, is poised to be published and will be sent to you. It reflects the views of a 14% return from 4,000 randomly selected households within the central areas of Tucson who are under the flight patterns of DM and/or TIA-ANG (ANG will be operating in concert with DM military training). *The majority of those respondents indicate that they are opposed to military flight expansion of any kind in Central Tucson.* Please study taking your flights and expansion to the many enormous expanses of less populated areas of Arizona.

The citizens of Tucson have constitutional and human rights to the pursuit of happiness; not to be the targets of a war conducted by our own government's military against us and depriving us of our health, safety, property, and happiness.

Sincerely,

s/Kathleen G. Williamson
Kathleen G. Williamson

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 10, 2014 10:18 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Comment on Draft Environmental Assessment on the Air Force's proposed Total Force Training program at Davis-Monthan AFB

From: commerce ingram [mailto:ib-j.i.-lec@cox.net]
Sent: Saturday, November 08, 2014 11:40 AM
To: 355 FW/PA Comments
Subject: Comment on Draft Environmental Assessment on the Air Force's proposed Total Force Training program at Davis-Monthan AFB

November 8, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB, AZ 85707

355fw.pa.comment@us.af.mil

(This is the electronic copy.)

From Jeffrey Ingram
3056 E. Camino de la Colina
Tucson AZ 85711

The Draft Environmental Assessment on the Air Force's proposed Total Force Training program at Davis-Monthan AFB is entirely invalid. Its methods are invalid; its conclusions are invalid; the direction in which it is pushing the Tucson community is invalid.

As a resident of Tucson who lives under the dome of descent paths into Davis-Monthan, I am acutely aware of specific airplane operations. There are a number of paths followed by various aircraft, and these paths smear out into a dome of noise impacts over my neighborhood just north of 22nd Street.

This is quite different from the notion that the noise can be averaged over a period of time, and thus judged to be acceptable or not. Day-Night Level noise averaging (DNL) as the sole method of noise analysis is irrelevant. DNL is a long-term average, and does not adequately represent the very loud short-duration noise of aircraft passing over our homes, and misrepresents the dome of noise impacts each Tucson area experiences.

The more important measure is the number of specific impacts during a day, a week, a year -- that would make living near this active landing field beyond what is acceptable.
The Environmental Analysis is therefore not relevant in trying to judge impacts of Davis-Monthan operations. The question of D-M operations has been actively considered for over ten years by the Tucson community. The Air Force should have been compiling accurate data over the past decade of the number of flights and the distribution of noise profiles from the various aircraft to give a correct analysis of D-M operations' impact on various parts of the Tucson metropolitan area. Then it would be possible to make a sound judgment as to to what the additional impacts will bring to the area. The idea is foolish that only the past few years can provide relevant information for sound

decision-making. If that data over the past decade and more is not available, then D-M's future plans should be suspended until the data can be generated and collected.

The DEA's preferred alternative would nearly double the number of flights here under the Total Force Training Mission counting US Air Force, Army, Navy, Marine Corps and National Guard pilots, as well as foreign-ally pilot training,

The actual areas of Tucson impacted should be accurately depicted on maps of the sound impacts. For anyone living under D-M noise domes, the information presented so far does not accord with real-life experience. The data offered is irrelevant, and needs to be replaced with data that accurately depicts impacts on those areas of Tucson.

There is the alternative for the Air Force to use Gila Bend AirField for its training purposes. It could be upgraded and used in such a way as to reduce descents into Davis-Monthan, as well as fly-overs of the city. The advantage for the Air Force of using Gila Bend is that it would allow greater flexibility in what they could do , without having to worry about flying over an urban population.

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:40 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Attention TFT EA Comment Submittal

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From: Jean de Jong [mailto:loct2985@yahoo.com]
Sent: Monday, November 24, 2014 6:05 PM
To: 355 FW/PA Comments
Cc: kathleen.ferguson@pentagon.af.mil; Mark.Welsh@pentagon.af.mil; WHALEY, TONI J Maj USAF AETC AETC/PA; ACC/CC Commander; Saf.ig@pentagon.af.mil; 355 FW/PA 355th FW Public Affairs; bobrien@az.gov; Mayor1.CHPO3.CHDOM2@tucsonaz.gov; Ward 1 Regina Romero; Ward2 Ward2; Ward 3; Ward 4 Shirley Scott; Ward 5 Richard Fimbres; Ward6; Ron Barber
Subject: Attention TFT EA Comment Submittal

November 14, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Dear Sir/Madame:

Comments re: the recent EA

Statistical Analysis seems to have two uses: (1) to manipulate and fudge the data to reach a predetermined outcome; or (2) to analyze data to determine what is in fact the case and to base action or no action and strategy on the facts that are revealed by the data collection and analysis.

The original intention of processes such as Environmental Assessment and Impact Studies is #2 (above) to analyze data to determine the de facto impact of new behavior and the impacts of that changed behavior on people, animals, and the environment and to determine the exact nature and degree of impact. The degree of harmful impact would be the determinant of whether and how the new behavior should proceed or not proceed at all.

Sadly, it looks extremely suspicious that this recent EA was based on major fudging of data, challenging the moral and ethical international standards for the use of statistics.

As well it looks very suspiciously like (1) data was selected and manipulated to make the positive economic impact of DM's adjunct mission economy on the local community appear greater than it actually is; (2) to maximize the appearance of local support for an expansion of adjunct missions at DM by taking into account a survey which sampled opinions from an area mostly not directly impacted by the overflights; (3) to minimize the negative impact to the local economy, especially the tourist industry, and most importantly to the health and well being of the local population exposed directly by the overflights; and to the property value of the homeowners and small businesses under these same flight paths; including the loss of investment for retirement in one's home.

It looks very much like a TAKING using data fudging and ANTIQUE analysis methodology to camoflage the de facto TAKING. Arizona as a State doesn't have the money to purchase homes, relocate citizens and/or pay the cost of retrofitting the homes that the new very loud and increasingly more frequent overflights demand so people can live without harm in their homes, including having nights of uninterrupted sleep.

This EA looks very strongly like a joint venture between State and local elected representatives and supportive associations, principally DM-50 to minimize economic costs to the military and the community while simultaneously setting up ways dump all the costs onto the citizens and homeowners most negatively impacted by the change the frequency and types of military overflights, as well as to make money off these new changes. Visiting squadrons from foreign countries are charged for the opportunity to visit here and do target drops at Barry Goldwater. The increased frequency and number of visitor pilots means more money for the Air Force as well as more money spent in community business and entertainment (when they go off the Base).

In nearly every news broadcast on this issue of adjunct visitor expansion there has been a very strong emphasis on the economic impact of DM on the Tucson community.

However, Washington Air Force's deciding where to base its missions is suppose to be based on defense needs -not on economic development or impact. Where the Air Force bases itself may have a secondary impact on the economy of the region but the impact of the economy on the region should not be a determinant of where the Air Force chooses to base its missions. I wonder what the BRAC commission would think of this thick collaboration between local AF and City and State elected officials and the infiltration of retired AF personnel trying to steer civilian affairs and politics to benefit DM?

Likewise the Air Force must determine its mission based upon its defense needs and not based on how much money the mission can bring into the Air Force piggy bank.

The Air Force and its host community also need to adhere truthfully, in good faith and good intention to laws and processes like the EA and the EIS.

And this clearly is what has not been done with this recent EA.

A fly over about a month ago of an F-22 in accompaniment with 2 F-16s left me stunned in my own home. It felt like I was suspended in a vacuum, like the air and life was literally being sucked out of me. I presently live outside any of the noise contour zones. I have epilepsy and high blood pressure so this incident left me feeling violated and disoriented and grateful that a more serious health crisis wasn't triggered by this incident. Did I bother to call in a complaint. NO. Each complaint takes 20 minutes to make and the outcome is always the same, in this case worse...our complaints are noted and ignored and the conditions we are complaining about are simply becoming unbearable. So few in their right minds bother to complain anymore. The few who do deserve a medal. They are speaking for 100s of us. So much for the validity of the complaint statistics collected by DM!

My direct personal experience of this one F-22 overflight incident convinced me that the way the EA analysis was conducted was seriously fudged to favor a predetermined outcome. To include these very powerful, deafening and sickening jets and their close cousins Harriers, F-15s, F-18s, even the F-16s in the EA and to come to the conclusion that they will have **no significant impact** on the environment, and people under their flight path flies in the face of all experience and reason. It is simply nonsense, and creative but deceitful lying. Lies that then set up the opportunity to steal people's health and savings.

I wondered about the inclusion of the F-22 in this Visitor jet profile. Why allow this dangerously loud and powerful weapon to fly into DM and use the City as its extended runway, and fly over a University with a day time population of 50,000; schools, churches, family homes, high rise student housing, businesses etc.?

The only explanation that made sense to me was that this bastardizing of the EA process and the intended outcome of this manipulation of methodology and data is most likely to keep DM here in Tucson in the middle of a City by sending a message to Washington that DM had the capacity to expand its mission to include even the most health damaging and unsafe jets to fly over the entire City on a daily basis, year round, with increasing frequency so that in the next 2017 BRAC decisions, DM would not be put on the cutting block - which the last BRAC threatened to do because of DM's serious encroachment problem. DM and its civilian supporters have since been attempting to send the message by adjunct mission expansion that DM can handle anything -even if it is located in the middle of the City.

A big part of this message is that DM can include in its mission any jet -even the F-35, which we know from the AF's own statistics permanently damages hearing after only 4 seconds of cummulative 24 hour exposure.

I think that what I experienced the other week with the F-22 overflight was something akin- a sneak preview if you like -of the impact that the F-35 will have on our physiology if allowed to fly over Tucson homes and residences.

And I strongly suspect that the F-22 was included in this EA line-up of jets so that a future EA and EIS can be claimed to be unnecessary when the Visitor nations who have purchased F-35s come to DM for their practice flying and bomb target practicing.

The Air Force and Washington and the industries building these jets have put all their eggs into one basket – the F-35. So if the A-10 is retired and the visitor nations begin flying more and more F-35s, DM will be closed down if it cannot as a base in the middle of a City be able to accommodate (at least on paper) the F-35 overflights.

There are obviously plenty of reasons that I have just described to motivate manipulation of data and unethical and immoral application of statistical analysis in this EA by a collaborative AF-local and State government.

I think the Air Force at this point needs to very carefully and with utmost honesty prove to the citizens of this community that it did not play 'let's play with the data to get the outcome we want'. Because everything about how this EA was conductive indicates that in fact they have manipulated the process to get the results they want, but results that are in fact very harmful to the citizens they have imposed them on.

So, what would I as a homeowner and small business woman under the overflight area need to feel that an EA was being conducted legitimately so that I could trust the outcome?:

. The Baseline date cannot be randomly chosen by the AF after never having done an EA after 1978. In 1978 as the AF has in its records there was an A-7 crash just outside Mansfeld Middle School and the U of A that killed 2 young women. Following that crash the AF changed the mission at DM to A-10s, but it did more. In a letter to a homeowner in the Broadmoor neighborhood the AF also committed to:"reduce the Air National guard activity at DM. (The AF proposed to) explore the possibility of alternate sites limiting the use of DM to Air National Guard aircraft that are similar to those stationed at DM and that would be compatible with DM operation. The letter closed by saying, - Please be assured that we are concerned about this problem and are working to minimize it within our capacities." So this date and any Visitor flight activities deviating from this time period and this decision related to this 1978 Class 'A" mishap should have minimally required an EA BEFORE the change was instigated.

Instead no EA was ever conducted over the years not even BEFORE major changes in the visitor program in 2002 when there was permanent housing for visitor squadrons built on the Base and when a temporary national winter program was expanded into a year round program that also included FOREIGN visitors.

So for the purpose of this EA the AF chose a Baseline date of 2009 after all the changes that they wanted to make were made. From this rational any date that minimized as close to zero the impact to the effected neighborhoods (on paper at least) would have been acceptable. Make the changes you want, then pick the date after the changes were made, and then state that the changes that were made after all the changes were made were insignificant. How dishonest and self serving and kicking legitimate process and the people who rely on legitimate process in the teeth!

. One of the biggest deceptions of the negative impact of jet noise is the averaging of the impact of that noise and vibrational force over a 24 hour period. If the effects of repeated jet noise leaves cracks in ones ceiling and walls then it most certainly has negative physiological effects on a person's health, children and the elderly in particular. There are enough solid peer review studies out there there describe accurately and in detail the negative impacts to the cariovascular system and to children's learning, to name a few.

It doesn't matter whether people don't notice the noise, like it or are extremely sensitive to it. The noise level and vibrational force of the jet will impact the individual and their property regardless of their emotional connection to it. (When it comes to physical violence some people make excuses for the person who commits it, some people like it and are addicted to it, and some people are very wounded by it. How the person feels about what has happened and how they explain it is irrevelant – it is a crime when one person inflicts violence on another without mutual concent, and even with mutual adult consent if it goes too far the offender will be arrested and charged). What the AF and its complicent civilians are doing is an act of violence, especially if they fudge the process to commit the violence by trying to make it look like they are not commiting harm.

. The process demands that the latest methods of statistical analysis be used and that these procedures be transparent and open for viewing, debate, discussion and revision.

. Finally, my understanding is that the AF is not suppose to be trying to influence the City and State officials to get its way, nor are the City and State suppose to be able to influence the AF. Again this is not suppose to be about economics. It is about defense and what the AF best needs to defend this country which includes us -we the citizens who pay through taxes the military wages and benefits, and the purchasing of the jets and supplies for the Bases. Yet, in 2004 the City passed NOTIONAL noise contours extending the overlay zoning into the Broadmoor neighborhood. This was intended to send a message to the AF and BRAC that the City was willing to give the AF anything they wanted even before the AF had done an EA and mission change which city ordinance overlay noise contours are suppose to be based on.

It seems the City and State elected representatives are willing to sacrifice their citizen's health, and well-being – not even knowing the exact and accurate impact to its citizens. And later to be complicit in fudging the investigation (at least not demanding accuracy and accountability) because they knew they wouldn't be able to afford to compensate their citizens for damage and loss and sound retrofitting.

When it came to mitigation for the F-35 in the Netherlands, because of the extreme cost two towns were demolished, Marrsum and Jelsum and parts of Leeuwarden. In Norway it would have cost $1.13 billion dollars to retrofit Bodo, a town of 40,000 people. So the town was scrapped for basing F-35s.

This fantastic notion that the F-35 can be slid through the backdoor into DM via this rigged EA which ruled **no significant impact** even with the expansion of the number of flights, year round and including every jet presently flown by the AF, and the process can be rigged so that given the inclusion of the F-22 and the close approximation of the F-22 and F-35, when the foreign visitor jets start bringing their newly purchased F-35s into DM, the next EA will determine that theses F-35s will have **no significant impact** as well to the citizens under the flight path. And conveniently with a ruling of **no significant impact** there will again be no financial cost to the City and State. How ludicus and criminal thinking is this given the comparison of how our European counterparts take care of and respect the citizens of their country who are put in harms way for the collective well-being.

This EA needs to be scrapped and completely redone in an honest, good faith way.

And meanwhile if the AF and elected officials and their supporters wish to see DM continue in its present location in the middle of a growing city then they should be entertaining missions for DM which are compatible with its present location. And if they insist on what I consider immoral and quite likely criminal behavior then they should right their wrong by moving the most seriously impacted homeowners, closing schools and financially compensating all who are negatively impacted.

Jean de Jong
2726 E. Malvern St.
Tucson AZ 85716
520-323-6870
loct2985@yahoo.com

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Friday, November 14, 2014 9:07 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: ATTN: TFT EA COMMENT SUBMITTAL

From: Dean Crothers [mailto:dcrothers@igc.org]
Sent: Friday, November 14, 2014 3:44 AM
To: 355 FW/PA Comments; secaf.office@mail.mil; PITTMAN, HEATHER F CIV USAF HAF U S AIR FORCE HQ/IEN; ACC/CC Commander; safiei.workflow@pentagon.af.mil
Subject: ATTN: TFT EA COMMENT SUBMITTAL

355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB, AZ 85707

I am writing to express my opposition to the Davis-Monthan AFB Total Force Training draft Environmental Assessment finding of no significant impact.

It is my understanding that the Davis-Monthan Air Force Base would like to increase (nearly double) the number of flights here under the Total Force Training Mission across US Air Force, Army, Navy, Marine Corps and National Guard pilots, as well as foreign-ally pilot training. This would include increased hours of operation, including night-time flights, and the use of much louder single-engine jets (F-35s).

The use of 2009 as a baseline for this DEA ignores the cumulative effects of all Davis-Monthan flight operations. An Environmental Assessment must include the impact of operations since the last assessment in 1978.

In 2008, the air force revealed that the F-35 would be about twice as loud at takeoff as the F-15 Eagle and up to four times as loud during landing. In 2009, the city of Valparaiso, Florida, adjacent to Eglin AFB, threatened to sue over the impending F-35 arrival. A USAF environmental impact study found that replacing F-16s with F-35s at Tucson International Airport would subject more than 21 times as many residents to extreme noise levels. The USN will need to redesign hearing protection for sailors to protect against the "thundering 152 decibels" of the F-35.

Daniel Kahneman won the Nobel Prize in Economic Sciences in 2002 for is work on decision making. He states in his book, Thinking Fast and Slow, that a paraplegic victim of a crippling accident, over time (as early as one month), becomes familiar with his new situation and his sense of well-being (his happiness level) returns to near normal. There are few exceptions to this tendency to adapt. These exceptions include chronic pain and constant exposure to loud noise. "Pain and noise are biologically set to be signals that attract attention.... There is therefore no adaptation to these conditions."

Noise analysis using Day-Night Level noise averaging (DNL) does not adequately represent the very loud short-duration noise of aircraft passing over our homes. The increased aircraft noise is likely to have a negative impact on the property values of homes in the Tucson and the sense of well-being of the people living here.

Thank you for considering a reassessment of the potential impact the this expansion of operations at Davis-Monthan Air Force Base.

Sincerely,

Dean Crothers, MD
5531 E. Towner St.
Tucson, AZ 85712

cc:
Deborah Lee James, Secretary of the Air Force

Ms. Miranda A. A. Ballentine, Air Force Asst. Sec. for Installations, Environment and Logistics

General Michael Hostage III, USAF
Commander, Air Combat Command
205 Dodd Blvd. Suite 100
Joint Base Langley-Eustis, VA. 23665-2788

Timothy K. Bridges, Deputy Assistant Secretary of the Air Force

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, November 20, 2014 11:54 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Davis Monthan Environmental Assessment

-----Original Message-----
From: zelnio [mailto:zelnio@cox.net]
Sent: Thursday, November 20, 2014 9:04 AM
To: 355 FW/PA Comments
Subject: Davis Monthan Environmental Assessment

Dear Sirs:

As a homeowner in the Broadmoor neighborhood, I strongly disagree with the conclusion of the revised draft environmental assessment of the Total Force Training program. Like the prior version, the conclusion that increasing training flights would have "no significant impact" on the community is incorrect. I am aware that the method used to determine noise levels is flawed and based only on general assessments. It also does not study the specific impact of the addition of newer planes with noise levels that far exceed that of the A-10 Thunderbolt.

The Tucson community has always supported DM. Now our city leaders and DM need to listen to the community and reject the most recent draft assessment. An increase in the number of training flights and, especially, the addition of planes that are much louder than the A-10 Thunderbolt II will adversely affect me and other residents whose homes and businesses lie beneath the flight path.

I am one of many residents who work from my home and, even at the current noise levels, I cannot be on the telephone during training flights. My windows and doors rattle to the degree that I fear they will crack. Property values and quality of life will be significantly reduced in this very important central business and residential core of the city. I urge you to reject this proposal and support the residents of Tucson.

Thank you for your consideration.

Respectfully,

Debra J. Zelnio
2820 E. Croyden Street

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, November 20, 2014 2:01 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: DM Environment Assessment Comment
Attachments: DM Env Assess Comment.doc

From: jeff dodson [mailto:istilljustwant@gmail.com]
Sent: Thursday, November 20, 2014 11:44 AM
To: 355 FW/PA Comments
Subject: DM Environment Assessment Comment

The proposed increase in the number of military aircraft training sorties will have a negative effect on low-income, minority, veteran populations along with a rare pristine native ecosystem.

I am a Desert Storm veteran (infantry). I reside a few blocks north of Mission & Ajo on the southwest side of Tucson. It is a low-income area where the majority of the population is minority. I recreate 2 miles away at Tucson Mountain Park, a 20,000+ pristine saguaro desert ecosystem that is connected to Saguaro National Park West, a federally protected area.

Military aircraft very frequently fly over this area. The proposed increase in the number of sorties, from 1400+ to 2300+ over this area will place an unfair burden on the population below.

Military aircraft are much more powerful than civilian aircraft. Civilian aircraft are seen and heard as they fly nearby and directly overhead, however, there is an additional effect that military aircraft have - they are felt, literally, in the bodies and psyches of the population below. I can feel them in my chest before I hear them and they are heard much sooner than they are seen as compared to civilian aircraft. This actually physically feeling the flyovers, not only has a general negative effect on quality of life, it can have, speaking for myself as a combat infantry veteran, also have a negative effect on one’s psyche. The proposed increase in the number of sorties over this area will increase the already negative affect on the low-income, minority, veteran, and perhaps native animal populations below.

Though Tucson Mountain Park serves this low-income, minority, population - ironically, it also serves a high-income tourist population from the Mariott Resort that accesses the park from trailheads on the north side of the park. It is common to have up to a dozen military aircraft fly over very low, with much impact, within a 1-2 hour hike, run, or mountain bike ride. So, the proposed increase in the number of sorties over this area will also directly and even more negatively impact (eco)tourism.

Perhaps if the additional proposed training sorties can be routed over higher income, less minority, less veteran-populated, less eco-valuable areas there might be a more broadly and more accurately felt perspective on how and who actually serves and sacrifices for the good of the whole country.

Jeff Dodson

The proposed increase in the number of military aircraft training sorties will have a negative effect on low-income, minority, veteran populations along with a rare pristine native ecosystem.

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From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Thursday, November 20, 2014 11:56 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Draft Total Force Environmental Assessment for Tucson, AZ

From: Jean-Paul Bierny [mailto:jpbierny@yahoo.com]
Sent: Thursday, November 20, 2014 10:40 AM
To: 355 FW/PA Comments
Subject: Draft Total Force Environmental Assessment for Tucson, AZ

To whom it may concern:

This is a **copy of comments I have sent to the Secretary of the USAF about the new Draft Total Force Training Environmental Assessment for Tucson**:

"Thank you for your most recent Draft EA for Total Force Training at Davis-Monthan Air Force Base and TIA in Tucson, AZ. It is indeed definitely better written than the previous one.

However, here are comments I wish to make about the current Draft EA :

1. Aircraft noise level measurements, used for the EA to come up with a FONSI conclusion, are made on misleading premises to address the impact of aircraft noise on the public: they are "computed over a 24-hour period and represent day-night average sound levels (DNL)" (3.3). DNLs are used throughout the Draft EA, including the drawing of noise level contours.

SEL is mentioned only once in the DEA:"Single-event noise, such as that caused by overflight, is described by the Sound Exposure Level (SEL)".
That is that a **major failure of the EA**: even though SEL is briefly mentioned, the **vast majority of the noise level measurements consists of DNL**. That is inappropriate, and misleading for the public.
People on the ground, during aircraft overflights, are NOT exposed to a day-night average of 24 hours (DNL). The reality that people experience is obviously

Single Events (SEL), relatively brief, but of a level a lot higher and more disturbing than calculated DNLs. **SEL measurements are the data that should be used, measured in a real life situation, not by computer modeling.**

The military generally uses OSHA or NIOSH **methods of calculating noise exposure to its personnel. These measures take into account both noise level and accumulated exposure time of the noise, to compute potential hearing loss. Civilians deserve the same kind of protection as military personnel**In addition, the "noise data" used for the current draft EA are still the same used in the draft AICUZ released in 2007...

2. How can **doubling the flights** over Tucson **NOT** affect the amount of noise the population will be exposed to? This claim is gratuitous and ludicrous and will be the basis for legal action against the EA because it is so obviously false.

Clearly, an EIS should be done before any expansion of operations that could cause environmental Impact. In particular, AIRCRAFT NOISE should be assessed, instead of making a glib FONSI decision based on inappropriate premises.

The USAF has already estimated by computer that F-18,and F-22s are 3 to 4 times noisier than A-10s, and that F-35s are 8 times noisier than A-10s. Nobody complains about overflights by A-10s. But the massive increase in noise produced by those other aircraft would be intolerable to very large numbers of people living in this large urban area surrounding these two airbases.

3. In addition, contrary to the Draft EA, it would undoubtedly have serious health effects: today, numerous scientific publications detail the effects of aircraft noise on hearing, sleep, mental concentration, blood pressure. It would be bad for our educational system, including the University of Arizona, and a disaster for our tourism industry (each of which affects Tucson’s budget with three times the financial impact of DMAFB)”.

Jean-Paul Bierny, MD
15, Calle Conquista
Tucson, Arizona 85716
520-881-4530 <tel:520-881-4530>

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Friday, November 21, 2014 2:45 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Comment on Davis-Monthan Draft Total Force Training Environmental Assessment (TFT EA)
Attachments: CCA TFT EA Comment Letter 11-21-14.pdf

From: Norm Meader [mailto:nmeader@cox.net]
Sent: Friday, November 21, 2014 12:17 PM
To: 355 FW/PA Comments
Subject: Comment on Davis-Monthan Draft Total Force Training Environmental Assessment (TFT EA)

To Whom It May Concern:

Attached is a comment letter from the Cascabel Conservation Association on the Davis-Monthan Draft Total Force Training Environmental Assessment (TFT EA). The Cascabel Conservation Association is located in the San Pedro Valley east of Tucson, Arizona, and Davis-Monthan uses our area for training exercises at times. We are thus concerned about increased low-alititude flights in our area as an outcome of the proposed increase in training missions outlined in this environmental assessment.

Thank you for considering these comments.

Sincerely,
Norm "Mick" Meader
Chair, Conservation Committee
Cascabel Conservation Association
(520) 323-0092 (personal phone)
nmeader@cox.net

CASCABEL CONSERVATION ASSOCIATION

SUPPORTING CONSERVATION, COMMUNITY AND CONTEMPLATION IN THE MIDDLE SAN PEDRO RIVER VALLEY

6146 N. Canyon Road, Cascabel, AZ 85602
(520) 212-4628 / www.cascabelconservation.org

November 21, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S Fifth Street
Davis-Monthan AFB, Arizona 85707
E-mail: 355fw.pa.comment@us.af.mil

Re: Comment on Davis Monthan Draft Total Force Training Environmental Assessment (TFT EA)

To Whom It May Concern:

This comment is on behalf of the Cascabel Conservation Association. Most of our 100+ members reside in the area east of Davis Monthan AFB along the San Pedro River in northwest Cochise County. Our purpose is to support conservation, education, and contemplation in the Middle San Pedro River Valley. For nearly two decades we have enjoyed a religious, educational and conservation tax-based exemption from Cochise County for the wildland spiritual and contemplative retreats that we host. Our physical activities are along lower Hot Springs Canyon and include a community garden, education center, and retreat facilities.

As you may know, this area of the San Pedro Valley is very special environmentally. Approximately 2000 acres of privately held land in the lower Hot Springs Canyon corridor have conservation easements on them held by the Bureau of Land Management and The Nature Conservancy. A recently announced group of conservation easements funded by the USDA's Forest Legacy Program increases protection of this ecologically unique area. Plant and animal diversity here is among the highest anywhere in the U.S., and the valley is the primary bird migration corridor in the Desert Southwest, where the Sonoran and Chihuahuan Deserts meet and the North American Rockies and Mexican Cordillera converge.

We note that the draft EA includes two flight paths across our area: (1) a military training route that runs from San Manuel across Hot Springs Canyon southeastward to the Willcox Playa, and (2) a low-altitude Class D flight path that follows the river valley from north of Benson to Winkelman. The draft EA does not state how much flights may increase along these paths, which we assume they will do. This concerns us. Our comment is driven by experiences of *very* low overflights by helicopters and C-130's in the past.

These flights have at times been only a few hundred feet above the ground and have badly shaken structures and frightened people as well as livestock and wildlife. Even the legal 400' altitude for helicopters is too low in this area. Although we often notify the D-M Public Information Officers of these events when they occur, this does little good. This activity is particularly disruptive to those seeking spiritual quiet at our retreat center, to local residents, and to the wildlife using the canyon as passage to the river and to other sky islands. Low-flying aircraft may also interfere with the major bird migration corridor within the San Pedro Valley and therefore to other values by extension.

The Cascabel Conservation Association thus requests a clarification of whether and how much overflights may increase in our area. We ask that all military aircraft maintain the maximum flight altitude possible when flying along the San Pedro River and within the area extending at least 4 miles to the east of Cascabel to avoid residences and the retreat center. While we realize that the military may legally be allowed to fly at very low altitudes in this area, this is nevertheless disturbing and disruptive to residents, stock and wildlife, something we feel can be mitigated with greater attention to flight patterns and altitude.

Thank you for considering these comments.

Sincerely,

Norm "Mick" Meader

Norm “Mick” Meader
Chair, Conservation Committee
nmeader@cox.net

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Friday, November 21, 2014 1:01 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Operation Snowbird Draft Environmental Assessment

-----Original Message-----
From: Dave Devine [mailto:ddevine1705@yahoo.com]
Sent: Friday, November 21, 2014 11:32 AM
To: 355 FW/PA Comments
Subject: Operation Snowbird Draft Environmental Assessment

In reviewing this document and its conclusions, several weaknesses are apparent. These are:
1. The continued reliance on NOISEMAP and BASE OPS to model noise contours instead of relying on actual noise levels leaves all conclusions concerning noise suspect;
2. The F-35 is not included in the list of Operation Snowbird planes. Does this mean it will be banned from flying to DM?;
3. How an increase of more than 900 sorties can have only an "insignificant" environmental impact is not substantiated by the report. As an example, 128 residences are to be included for the first time in the 65 dba zone off the northwest end of the runway and the report states: "noise contours would likely be imperceptible to the residents." That assumption is questionable. What isn't questionable is that these residences will, for the first time, have to comply with Arizona legal requirements about notifying potential buyers of the units about the noise zone. That will have consequences that should be examined;
4. Finally, labeling the noise and other impacts as "insignificant adverse impacts" minimizes the role Operation Snowbird plays now and will play in the future. Thus, a more complete review of the environmental impacts is required.
Dave Devine

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Friday, November 21, 2014 1:03 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: EA

From: Jamie French [mailto:jmerfrench52@gmail.com]
Sent: Friday, November 21, 2014 11:51 AM
To: 355 FW/PA Comments
Subject: EA

Jamie French

2719 North Geronimo Avenue

Tucson, Az. 85705

520-282-9798

Thank You for giving me this opportunity to respond to the EA.

This EA is based on miss-information. Therefore the EA is invalid.

1) **The DMAFB Flight Paths. Why does DM fly everywhere, on the Northwest Side, except the designated Flight Path? (I have personally made over 1,000 LOCATION COMPLAINTS in the last 4+ years.)**
2) **The DMAFB Flight Elevations. Why does DM often fly LOW and/or FLAT over the Northwest side of Tucson? The tower has confirmed that there have been flights at less than 500 feet, and many other arrive and depart at less than 1,000 feet at 7.5 miles out. Why? (I have made an extraordinary amount of ELEVATION COMPLAINTS to DM Hotline.) (Note: These aircraft ARE NOT in a flight path.)**
3) **Time of Flights/Late Flying. Why does DM have frequent AFTER HOURS flights, low, and not in Flight Paths, arriving and sometimes departing over the Northwest side of Tucson? (PA explained that 22:30 EQUATES TO 2:30 AM. The Public is NOT STUPID.)**
4) **Departures over the city. Due to Safety, DM is not to depart over the City BUT is to use the Multi-Million Dollar Approach/Departure Corridor. Why does DM NOW depart low, not in a flight path, and often after hours over Tucson? (Departing in The Corridor then doing a hairpin turn and flying low and flat over the city is also wrong.) Is a departing ageing Tanker with 200,000 pounds of jet fuel over our neighborhoods considered safe? (not in a flight path)**
5) **Property Values. Why have my/neighborhood values gone down 40% + since you have been flying over us?**
6) **Geological Aspects amplify massive Acoustical Vibrations. Why does my house shake like a bowl of Jello when you fly over me? This is due to the Geographic make-up**

of Tucson… (If you flew in your Approach/Departure corridor or the Flight Path this would not be an issue.)

7) <u>Noise</u>: Why does the basic right to be outside infringed on by LOUD aircraft, not in flight paths, flying low, flat, and late? These aircraft have never been approved to fly into DM. there is no EIS or Sound Monitoring for these enormously loud aircrafts with sound waves of 3/10+/- miles.

8) <u>Planes that were never approved</u>: Why do F's, EC's, KC's fly constantly over us? Only A's, C's, & Helicopters have been approved to fly/based here.

9) <u>Attitude of Base</u>. THERE MUST BE A WAY TO PROTECT AMERICANS WITHOUT HARMING US.

10) <u>Comments from base Personnel</u>:

- **I have been informed that Civilians "…HAVE NO INTRINSIC VALUE…'**
- **"Why do you people bother us (Public Affairs) by calling us with questions and problems?"**
- **"The Flight Path is anywhere that we fly."**
- **"We built Tucson and we can do with is anything we want".**
- **"When will you people get it through your heads that we, The Military, can do whatever we want, whenever we want, to whom ever we want to do it to?"**

11) <u>Why does no one ever help us</u>? Why does no one address community concerns? Why are Hot Line calls ignored?

12) <u>Promises</u>. Why does DM not keep any of their promises?
Prior to building the DM Base there was great opposition from the community. DM promised TO NEVER EVER FLY OVER ANY EXISTING NEIGHBORHOODS. So WHY do they fly over these neighborhoods? Not in flight paths? Not at proper elevations? Not at approved times?
How about the WE WILL FLY AT 1500ft over Tucson (in flight paths) promise?

13) <u>Is it proper to use our community to practice war games on by diving bombing us… and twirl drops on our homes and schools</u>? DM is already SIGNIFICANTLY affecting the quality of our lives without increasing flights sorties.

14) <u>DM Letter to me</u>. After 100s of request, from me, to please respond to my Hot Lines calls, a letter was written to me. It said that they, DM, can do what ever they want since there are no rules governing them. REALLY?

In conclusion, when reading through the EA there is so much miss-information that the entire EA should be an INVALID DOCUMENT.

Our lives are CURRENTLY SIGNIFICANTLY IMPACTED by Military Aircraft… any INCREASE WILL SIGNIFICANTLY AFFECT US.

TFT EA Comment Submittal
355th Wing Public Affairs
3405 S 5th St
Davis Monthan AFB AZ 85707

11/21/14

I live more than two miles north of the north-west corner of DMAFB, in the Peter Howell neighborhood.

C-130s rumble directly over my house, often at night, and often in a repeating pattern for hours at a time. Most weekday mornings when I leave the house, I can distinctly smell unburned jet fuel hanging in the air. Most days at all three work locations to which I commute, I need to carry earplugs in my shirt pocket to protect my hearing from jet noise, while I walk from car to buildings or between buildings. The three locations are: Hemisphere Loop and Palo Verde, Rita Rd and I-10, and E Hermans Rd. From the latter location I can see F-16s take off, with the pilot executing an immediate (an unneccessary) Immelmann turn at full throttle.

The Environmental assessment says essentially that there will be no impact from doubling the traffic and including far louder airplanes. That conclusion must have been a rubber stamp. The assessment needs to be redone. It's the peak noise that matters, not the long-term average noise contour. And pilots routinely disobey the strictest protocols for noise abatement.

My neighborhood is about as old as Davis Monthan, so it's not a case of inappropriate development or encroachment. The noise levels in the 1930s, with piston-engine airplanes of at most a few hundred horsepower, were a fraction of those today. There are already large swaths of low-income neighborhoods with deteriorating housing from 22nd St south to Valencia and beyond. Most of my upper-middle income colleagues choose to live in Oro Valley, the Catalina Foothils, or Sahuarita in spite of the very long commutes, and it isn't just for the school districts. Double the traffic, and introduce a loud new airplane like the F-35, and large areas of Tucson will become uninhabited, except by the very poor.

I am an engineer for a defense contractor, working mainly on Air Force contracts for the past 30 years. I fully support the Air Force in its missions. However, I believe that training, and especially high-intensity training, should be moved away from peoples' homes and businesses, rather than expecting people to relocate away from Air Force training.

Bruce Ferrell

Bruce Ferrell

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 10:09 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Air Force endangerment of citizen health, property values and economic prosperity.

From: Guy Josserand [mailto:guyjosh3@gmail.com]
Sent: Sunday, November 23, 2014 11:36 PM
To: 355 FW/PA Comments
Subject: Air Force endangerment of citizen health, property values and economic prosperity.

Dear Persons:

First of all jet noise is not the sound of freedom. Freedom of speech and the free press are the sound of freedom. Which freedoms, by the way, are quickly vanishing along with market freedom by the monopolization quickly placing its iron grip on almost every industry from media to food to banking to retail to energy to control of military power. Economic monopolies are as deadly as political ones. Monopoly is the destruction of the free market and is no more compatible with democratic government than was Hitler, Stalin, Mussolini or Pol Pot. But that is a different conversation. Suffice it to say that jet noise is the sound of profit taking and the monopolization of defense that Ike, a Republican, warned us about.

Besides the anti-American and democracy destroying impact of the military/industrial complex, DMAFB has contributed to a considerable devaluation of property in Tucson because of the disruptive noise that has plagued the UA and Tucson business and tourism for decades. I know people who missed several minutes of college level instruction daily at the UA back in the 70's. It is costly to silence a professor for even a minute and disruptive of students mental processes. Sure people survived. Survival is not to thrive which is what life is all about.

But the sickening thing about the current DM debacle is the shameful display of dishonesty and disrespect shown by what should be the nations most respected institution. It has rigged the data in the Environmental Assessment by not even using the same SEL measuring tool used for their own AF personnel and instead relying on the ridiculous DNL tool which averages in all the quiet time!!! It is analogous to declaring that if you don't drink all day then the four highballs you have at night are of "no significant impact." It is like allowing some cars to drive 1000 miles per hour as long as the average of all cars is under 75 mph. Extraordinarily fast cars are going to cause extraordinary accidents and extraordinarily loud planes cause extraordinary disruption to living organisms.

Yes defense is a critical function of government and yes the US has become the world cop. However, now even the Pentagon has declared that the top threat we face is in fact ourselves in the form of our quickly degrading human habitat by forces of blind greed. Truly the profit motive has devolved, as it always will if not held in check, into what is widely known to be the root of all evil, the love of money, greed. So it is that addiction to avarice, in addition to being the top threat, also fuels and fans the flames of avenging martyrdom. The Pentagon has also identified two equally important legs of national security beside military power. The three legged stool of security includes military power, diplomacy and economic development. And it is not military power that is anemic and underfunded and most in need of being deployed. Let's let the security "legs" that are the "carrot" side of the stool and which are able to produce peace and stability catch up now. Let's begin to practice the Golden Rule that is so fervently and widely believed and seldom used. And let us rely less on "stick" side which has given us such limited and marginal results.

Guy Josserand
Tucson, AZ 85716
guyjosh3@gmail.com

"The end of democracy and the defeat of the American Revolution will occur when government falls into the hands of lending institutions and moneyed incorporations."
~ Thomas Jefferson

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 10:09 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: ATTN: TFT EA COMMENT SUBMITTAL

From: Maggie Leonard [mailto:fasola.mags@gmail.com]
Sent: Sunday, November 23, 2014 11:51 PM
To: 355 FW/PA Comments
Subject: ATTN: TFT EA COMMENT SUBMITTAL

Dear Sirs, I would like to comment on the TM environmental impact study. There are 3 main concerns I have that have still not been addressed in the current draft:

1) there needs to be a more accurate (and transparent) reporting on the impacts to Tucson neighborhoods and businesses affected by overflights. The draft EA measures noise in 24 hour increments versus single incidents. So if I'm woken up every 15 minutes by night flights of F-16s for a period of 2-3 hours which then takes a toll on my health and my ability to perform well at work the next day (which has happened in the past), this is what I would call "underreporting" the effects on the community.

2) The EA assumes that the current noise levels (and community comfort levels) will not change while remaining silent on the whole question of mission change or guest missions (such as bringing F16s or F35s). There needs to be language in the EA that specifies all is contingent upon the A10s remaining at DM and the mission remaining essentially the same. The EA needs to be clear that should louder, more dangerous planes be based at DM, all bets are off and the EA needs to be re-done. My guess is that after 6 months of F35s or F16 flybys a much larger swath of the community will suddenly be objecting to the noise because they had no idea how much exponentially louder the newer planes are. You can't sign a contract for one house, and then be told you have to live in a different house than you signed for, one with a leaky roof and no plumbing. That's called "bait & switch."

3) The remaining concern is philosophical and I don't suppose you have an answer for it. Why are we replacing the A10, which purrs like a kitten it is so quiet, is highly manueverable, and is the #1 most trusted ground support in combat operations by the troops. But the F16, the F35 are constantly crashing, not as manueverable, and basically good for dropping bombs from high altitudes--something drones and guided missiles are much better at. I know it has something to do with politics, and big money, and a couple of big shots' careers, and absolutely nothing to do with what would make the troops actually safer. And, I suppose, those same political and money motivators are what is driving the hubris that has DM boosters trying to bring F35s to the most densely populated airforce base in the west. Ya'll, I just want to say that is plain stupid. You want to keep DM? With F35s? with Iraqui pilots flying F16s? The last DM crash in Tucson almost closed the base down, and that was a poorly maintained A10 that went down. F35s go down with the best maintenance in the world because they are just badly designed. And they lack the ability to land on a postage stamped spot of green behind Tucson High like that A10 pilot so heroically did back in the 70s. I'm just saying is all...

Okay thanks for reading this.

Maggie Leonard, 4241 E. Linden Street, Tucson, AZ 85712, 520-323-5049

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 10:25 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: new draft of Operation Snowbird

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From: Cathy Della Penta [mailto:c.della@cox.net]
Sent: Sunday, November 23, 2014 11:16 AM
To: 355 FW/PA Comments
Subject: re: new draft of Operation Snowbird

Ladies and Gentlemen:

The mid-Sept. issuance of a revised draft environmental assessment of the Total Force Training program or “Operation Snowbird” has serious flaws in its assumptions and I am against its conclusions that increasing training flights would have “no significant impact” on the community.

The current main fighter fleet is mainly comprised of relatively quiet A-10 Thunderbolt II close-air support jets. They make noise enough as it is, but bringing in much louder planes than the ones currently stationed at D-M would have profound negative impacts on the environment, including noise pollution and air pollution.

I live in Civano, directly behind the Davis-Monthan base. In the short 5 and 1/2 months I have lived here, I have endured several sonic booms that caused all the windows in my new home to rattle, and the booms caused me much distress. In addition, helicopters run *sorties* across the entire community where I live, most of the time during the day. However, there was one night when helicopters flew over my home more than 25 times all night long. It was impossible to sleep.This is the current situation.

However, if more planes, bigger and heavier planes, louder planes were allowed to use the facility, the air pollution alone for the city of Tucson would drastically increase. The noise pollution would very adversely affect my community and the city as a whole as well.

I urge you to please consider the “big picture” in your decision making capacities, and recommend against the immediate and long term consequences of visiting-aircraft training at Davis-Monthan. Tucson is a city of a million people and it is very spread out. The base is not situated on the far fringes of the city anymore. It is surrounded by communities on all sides. Perhaps a better choice for this program would be a place with far fewer people and vast expanses of desert, such as Yuma.

Thank you for your time and consideration in this matter.

Sincerely,

Cathy R. DellaPenta
10601 E. Marchetti Loop
Tucson, Az 85747-6085

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 10:23 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: overflight noise disturbances

From: Cara Gibson [mailto:cara.m.gibson@gmail.com]
Sent: Sunday, November 23, 2014 4:00 PM
To: 355 FW/PA Comments
Subject: overflight noise disturbances

Hello,
I am writing to express my concern about the overflight noise that myself and family currently find disruptive and worry that there may be additional flights.
More research and discussion should be conducted to ensure that the proposal for additional planes will not increase disruptions in or risk to the community.

It appears that the Environmental Assessment that was conducted found no significant impact. However, it is unclear whether a representative population was surveyed to address whether Tucson's citizenry in actual fact found the current overflights a noise disturbance. Additional Tucson residents in the zip codes most affected by noise, such as ours, 85716, should be surveyed.
In our own household, for instance, when overflights occur the windows rattle, conversations must pause, my son is roused from his nap or has a hard time settling down for sleep.
These events are clearly disruptive for our family.

It seems there is some confusion over what exactly is proposed by Davis Monthan and over what timeline. It would be more neighbourly to have explicit and transparent conversations about these issues with the community. What planes are proposed for flights? What are their associated noise and risk levels. It would be awful to repeat the tragedy of 1978 where 1 died and six were injured (http://tucson.com/news/blogs/morgue-tales/tales-from-the-morgue-a-jet-crashes-in-tucson/article_af3ff59e-5947-11e4-ab8d-4b5ae6bde82c.html).
Minimally, wouldn't a possible compromise be to simply adjust flight paths so that they occur over the least populated parts of the state?

Finally, I think that the air force owes it to the community to fund or conduct more research on the ill health effects that arise due to the noise that these planes generate. For example, there is evidence that children do not learn as well with this kind of repetitious, loud background noise, adults suffer undue stress and animal populations can even abort offspring when exposed (http://citizensofebeysreserve.com/HealthArticles.html).

I would very much appreciate a written confirmation that my correspondence was received.

Very best,
Cara Gibson

TUCSON FORWARD, INC.
P.O. 42472
TUCSON, ARIZONA 85733-2472

<tucsonforward@tucsonforward.com>

http://tucsonforward.com/

Attn: TFT EA Comment Submittal
355th Fighter Wing Public Affairs
3405 S. 5th St
Davis-Monthan AFB, Arizona 85707

Re:
Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona *(This correspondence is being sent via email and a postal mailing will follow)*

November 23, 2014

To Whom It May Concern:

Davis-Monthan Air Force Base is located inside the city limits of Tucson. The Air Force itself, has said their plan will greatly increase the number of overflights and will bring in much louder, riskier fighters such as the F-18 and F-22.

Therefore, for this DEA to claim a "Finding Of No Significant Impact" can only mean that the DEA has been manipulated to produce a false result.

One of the main ways this has been accomplished is through the use of inappropriate, inadequate, obsolete methods for measuring and analyzing the impact of noise. The use of the DNL as the only tool is not sufficient to measure the full impact of military overflight noise on residents under the flight paths, or to determine the extent to which the noise contours should be increased.

Justifying the use of the DNL alone, by citing a forty-year old (1974) USEPA recommendation, and continuing to insist on using only the DNL, when that is no longer the recommended method, reflects very badly on the Air Force.

It is also an insult to the community of Tucson, which has hosted Davis-Monthan all these years. NEPA intended the EA to be a means of ensuring the protection of host communities, and these shabby attempts to circumvent that intention, should not be taken lightly, and is, in fact, an invitation for litigation.

Up-to-date scientific methods must be used to determine the full impact of the planned expansion on this community's residents. That means the use of SEL to measure and analyze the effects on: residents' physical and emotional health, residential property values and the tax revenues depending on them, businesses such as restaurants, hotels, resorts, golf courses, local environmental attractions such as the Arizona Sonora Desert Museum, elementary schools middle schools, and high schools, the University of Arizona (already negatively effected by overflights), Pima College, parks (such as Reid Park and the Reid Park Zoo, which are directly under the flight path), child care centers, hospitals, medical clinics, places of worship, tourism (with direct contributions to Tucson's economy of almost twice as much as Davis-Monthan), the general quality of life of Tucson residents in our culture, where great value is placed on being able to enjoy being out on the patio or in the yard year-round.

In addition, Tucson residents have long complained that aircraft from D-M frequently fly outside of the flight paths presented in the EA. This has been verified by Air Force staff, who have stated that the pilots are allowed to fly anywhere in the Tucson area.

This EA states that areas exposed to a DNL above 65 dBA are "generally not considered suitable for residential use." However, the contours show flights over residential areas in this zone (EA at 3-4, Figure 3-2). Yet there is no analysis given regarding the impact of the plan to further increase flights over these residences. This is one of many examples where supplemental metrics are critical to evaluate the full impact with accuracy.

The situation here in Tucson clearly requires nothing less than a full in-depth EIS using the most up-to-date scientific tools and methods.

Another of the shameful failures of this EA is in the area of any public involvement. Many of the important analyses were not shared with the public, and there was no Spanish version of the Revised EA, despite the fact that most of those residents who live closest to D-M are Spanish speaking.

In addition, this EA is extremely long, complex, and technical. Most working families do not have much time to devote to reading and understanding the EA and its conclusions. This means that a much longer period of time is necessary to provide adequate opportunity for the public to read and critique this EA.

One of the most egregious failures of this EA is the lack of attention to environmental justice. Even though the EA itself admits that there is a disproportionate impact on low income and minority residents, there was no effort to reach out to these populations to advise them of the Revised EA. Even the Julia Keen neighborhood (which is the most effected neighborhood, and where a school was previously closed due to military overflights) received no flyers or post cards advising of the release of the Revised EA.

Instead the Air Force relied almost entirely on notification via the Internet, even though low-income minority households are less likely to have access to the Internet.

Only the "FONSI" was translated into Spanish. This is not sufficient to allow for significant participation by the very residents that the Air Force admits are disproportionately affected by the proposed plan.

Another glaring problem with this EA is the choice of a bogus baseline. There has not been an EA of Operation Snowbird (OSB) since 1978.... clearly a violation of NEPA requirements. The other operations included under the Total Force Training program (TFT) have never had an EA.

Since 1978 the OSB program has undergone enormous expansion. What began as a couple of months in the winter only, morphed into a year round program, which has continued to increase the number and types of planes and the number of overflights. In fact, by the year 2000, it had already undergone very significant expansion in violation of NEPA, which requires an EA **prior** to any significant expansion.

It is therefore obvious that setting the baseline anywhere other than 1978 is a further violation of NEPA and the intent of NEPA, which is to protect the environment (including the human environment).

The Revised EA, as did the original EA, fails to address health impacts, despite the fact that valid scientific studies from prestigious institutions in the US and the UK, have found statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular diseases.

This EA ignores the effects on children living within the 65 decibel contour, and because of the skewing of results by use of the outdated DNL, it also ignores the effects on children attending schools and day care centers which would (if measured properly) be within the 65 decibel contour.

This Revised EA does not provide an adequate analysis of cumulative effects. It simply lists some of them, and doesn't even list others. NEPA requires analysis (not just listing) of OSB activities from 1978 through the present. Aircraft currently flying, were not being utilized in the OSB program in 1978. Therefore analysis of the effects of those aircraft must now be provided as part of the cumulative effects of past actions. In addition, there were aircraft, which are not currently flying, but were flying at some point between 1978 and the present, and were flying over Tucson via the OSB program.

Therefore the Air Force should determine whether the impacts of those aircraft are the same (or similar) to aircraft now proposed for addition to the OSB program. If they are similar, the AF should analyze those impacts, add them to the EA, and make them available to the public.

Even though this Revised EA now lists 18 different aircraft that have been flown via the TFT program, it fails to provide any risk analysis for 10 of those aircraft (for example, the F-18).

In addition, the EA considers only class A mishaps, completely ignoring the fact that a class B mishap could permanently disable a civilian on the ground, and even a class C mishap could do significant damage to property.

It fails to address the concern that having pilots, who are not based here, flying over Tucson, when they are not familiar with the airspace here, creates a greater risk. It also does not address the fact that having foreign pilots flying these single seat jets over the densest portion of Tucson is an additional risk factor, considering that there have been a number of incidents where the tower and the pilot did not understand each other due to the pilot's lack of English fluency.

Regarding the "No Action Alternative".... in order to use this term, this EA assumes the existence of an OSB program allowing year-round flying of aircraft other than A-10s. However, there is nothing validating this. There was no NEPA-required EA before beginning these activities. Instead, they began and continue to take place with gross disregard for NEPA’s requirement that all federal actions undergo prior environmental review.

Therefore, the use of the "No Action Alternative" as it is used in the current EA is another violation of NEPA. It was fabricated by the Air Force, and is legally unacceptable. The courts have repeatedly found that "ex post facto environmental review cannot cure an initial failure to undertake environmental review." Therefore, when an agency has failed to conduct a NEPA-required EA for a prior decision, it cannot validate that prior decision in a subsequent NEPA analysis that fails to remedy the earlier failure.

In addition, the Revised EA still has serious methodology problems in its assessment of property values. A truly meaningful analysis of aircraft noise on property values of neighborhoods near D-M and ANG and on neighborhoods under and near those flight paths, would encompass the time frame from 1978 to present.

It would include the year-to-year property values along with the year-to-year changes in aircraft noise levels over those neighborhoods. It would compare those property values with the year-to-year changes in property values of other areas of Tucson.

To perpetrate a devaluation of property values through increasing military aircraft noise for a period of 36 years, and then use the current value as a baseline in determining the significance of further devaluation, is a tactic one would expect to see in a silent film, such as the Perils of Pauline, with the perpetrator of this dastardly deed twirling his mustache. It is hardly befitting the U.S. Air Force.

The Air Force plan for the Tucson-hosted Davis-Monthan AFB will not be appropriately or adequately addressed without a full in-depth EIS utilizing the most up-to-date best scientific methods and tools.

Respectfully,

Lee Stanfield
TFI Board member

23 November 2014

ATTN; TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affair,
3405 S Fifth St.
Davis-Monthan AFB, AZ 85707

Dear Sirs:

The Pima Association of Taxpayers, has numerous concerns relative to the most recent D.M. Environmental Assessment, EA done by Gulf South.

First, the noise markers do not coincide with the noise contours. Those markers however, match precisely with Gulf South's previous EA. Since noise and safety were the primary elements studied in the EA the above error raises serious concerns about the accuracy and professionalism of the study.

Second, the study fails to reflect the fact stated by the FAA on Base that over 90% of D.M. aircraft return using Visual Flight Rules, VFR. That volume of VFR traffic returning use the race track pattern which should have activated the Air Force's curved Accident Potential Zone, APZ. That means D.M. is flying over three schools in addition to the former Keen School and dense residential development all within the APZ, a flight path to be avoided according to the Air Force's Air Installation Compatible Use Zone, AICUZ, a safety concern not identified in the EA. That safety problem should have been identified in the EA and the solution put forth - to have D.M. aircraft land long as the F-16 pilots do at Tucson International Airport. As for the noise contours they curiously avoid those three named additional schools even though D.M.'s VFR flight pattern document shows planes flying directly over those schools.

Do to the aforementioned concerns the following information needs to be made available:

1. How much in total payments did Gulf South receive for the two studies?
2. Were those studies competitively bid?
3. Who were invited to bid?
4. What were those bids?
5. Were there any conflicts of interest in the awarding or execution of the

contract?

Thank you for your evaluation of our concerns. We would appreciate a written response to those concerns in the name of enhanced safety for both D.M. and the community. We also wish to ascertain if a judicious use of taxpayer money was involved.

Richard Basye

Richard Basye, Pres.
Pima Association of Taxpayers
P.O. Box 35241
Tucson, AZ 85740

Copies to -
TBD

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 2:37 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Attn: TFT EA Comment Submittal
Attachments: TFI 2nd letter to AF re TFT EA 11-24-14.pdf; TFI Survey Press Release Revision B 11-09-14.pdf; TFI Survey Results (Final) 11-05-14 with map.pdf; Notes re Zip codes & margin of error.pdf; COMPARISON OF TUCSON FORWARD AND SADA SURVEYS 11-09-14.pdf; Background & History.pdf

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From: Lee Stanfield [mailto:simplee@cox.net]
Sent: Monday, November 24, 2014 1:01 PM
To: 355 FW/PA Comments
Subject: Attn: TFT EA Comment Submittal

TUCSON FORWARD, INC.
P.O. 42472
TUCSON, ARIZONA 85733-2472

<tucsonforward@tucsonforward.com>

http://tucsonforward.com/

Attn: TFT EA Comment Submittal
355th Fighter Wing Public Affairs
3405 S. 5th St.
Davis-Monthan AFB, Arizona 85707

Re: Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona *(This correspondence is being sent via email... a postal mailing will follow)*

November 24, 2014

Tucson Forward, Inc. recently completed conduction of a survey of 4,000 randomly selected residents from the 29,093 residents of Tucson, Arizona who are most heavily impacted by current and proposed overflights by military fighters under the auspices of Davis-Monthan and Air National Guard training operations.

The results of this survey show that a majority of respondents are opposed to the louder and riskier aircraft (such as the F-18 and F-22) as well as a greatly increased number and frequency of overflights, which are components of the Air Force plan to expand the Total Force Training Operations.

Therefore, Tucson Forward is officially requesting that the Air Force conduct a much more in-depth Environmental Impact Study (EIS) utilizing the most up-to-date best scientific methods and tools, to assess the true impacts of the Air Force plan for operations effecting the Tucson area.

We have found the current Draft Environmental Assessment to be greatly flawed in numerous ways, which were addressed in our previous letter signed by Board Member Lee Stanfield.

Attached to this letter today, you will find the TFI Survey, one sheet of notes re zip codes, margin of error, etc., the press release announcing the survey results, a comparison of the TFI Survey with the SADA Survey, and a 2-page background and history document on TFI.

Respectfully,

TFI Board Of Directors

Mary Terry Schiltz, President
Kathleen Williamson, Vice President
Anita Scales, Treasurer
Carol Stoner, Director
Lee Stanfield, Director

TUCSON FORWARD SURVEY

REGARDING MILITARY OVERFLIGHTS

PURPOSE

The Tucson Forward survey was designed to provide residents of the Tucson neighborhoods most affected by military overflights, an opportunity to anonymously state their opinions about Air Force (AF) plans to increase the frequency of overflights as compared to the current level of Operation Snowbird, and to bring in noisier, riskier aircraft.

EXECUTIVE SUMMARY

* Fifty-three to 57% of all responses were opposed to replacing the fighters that regularly fly over Tucson, with F-18, F-22 and F-35 jet aircraft.

* There was slightly more opposition to increased noise (57% re Davis-Monthan, 56% re Air National Guard) than to the increased safety risk (54% re D-M, 53% ANG) from the Air Force's plans to expand the number of overflights and bring in the newer jets.

* Very strong support exists (83%) to keep Davis-Monthan Air Force Base open with the current fighters and current overflight operation levels.

* However, this support drops to 59%, (a drop of 24 percentage points) if the noisier, riskier fighter airplanes are brought in.

* Strong support (63%) is expressed for limiting operations at D-M and ANG to those operations currently in place.

* A clear majority of respondents (66%) were previously unaware of the much larger direct economic contribution of the tourism industry to Tucson (4.6% of GDP) as compared to that of Davis-Monthan (2.6% of GDP).

* There is wide variation in the responses from different parts of the city (see section on analysis by zip code) that can be correlated with their proximity to the D-M and ANG runways.

METHODOLOGY

Consultation and advice regarding survey design and process, analysis and interpretation of the results were provided by Margot W. Garcia, PhD, AICP, who is a retired professor of urban planning. Professor Garcia studied statistics and surveys with two internationally known sociologists, Beverly and Otis Dudley Duncan, and has taught courses at Arizona State University and Virginia Commonwealth University on developing valid surveys, and on the conducting and analyzing of the results. She has been a co-principal investigator in large national surveys conducted for the U.S. Army Corps of Engineers, and has supervised doctoral students in a variety of surveys covering many topics.

To obtain the addresses for all single-family residential dwellings in the neighborhoods we wanted to survey, Tucson Forward utilized the services of a locally owned professional list service *That List Lady*.

A locally owned Tucson mailing house *Arizona Jet Mail* provided the services of mailing out the surveys and tallying the responses. The survey was mailed to 4,000 residents in Metro Tucson neighborhoods which are either currently most affected by military overflights, or that are likely to be most affected, if the AF plans are implemented to expand overflights.

The random selection of 4,000 residents from the 29,093 single-family residential dwellings in the area targeted, was done online via *Research Randomizer:*
http://www.randomizer.org/form.htm

The survey was mailed out to the 4,000 residents the first week of August 2014. Responses were accepted until the first week of October 2014.

Participants were advised in a cover letter that their responses would be kept anonymous. They were asked to provide only their zip codes on the responses. Return envelopes addressed to *Arizona Jet Mail*, were provided in the envelopes containing the surveys.

Participants mailed responses directly to *Arizona Jet Mail*, who provided the tallying.

Information on aircraft noise comparison cited in the survey was obtained directly from Air Force data (Table E-2 of the Eglin Air Force Base Environmental Impact Statement and the "ACFT dB Level" provided by Davis-Monthan AFB).

Economic comparison information cited in the survey was obtained from Davis-Monthan's economic analysis for FY 2012 and the U.S. Bureau of Economic Analysis for 2012.

Zip code boundaries and demographic information used in this analysis of the survey responses, were obtained in October 2014 at the following websites:

www.city-data.com/zipmaps/Tucson-Arizona.html

http://www.usa.com/85745-az-income-and-careers--historical-employment-status-data.htm

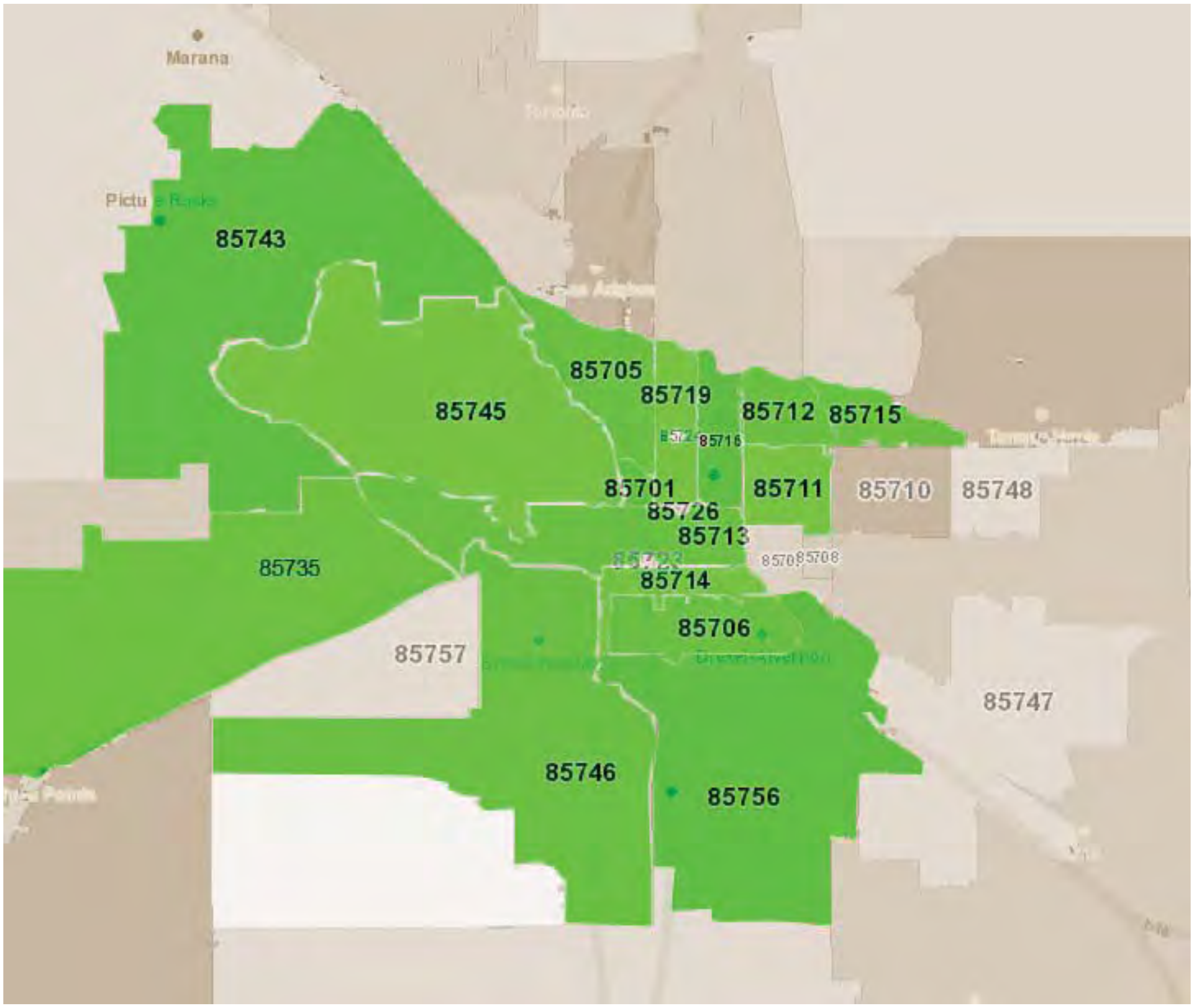
SURVEY RESULTS

PARTICIPATION

The rate of response to the 4,000 mailed surveys was just over 14% (a total of 571 responses).

The survey area covered the following zip codes: 85701, 85705, 85706, 85711, 85712, 85713, 85714, 85715, 85716, 85719, 85725, 85726, 85735, 85743, 85745, 85746, and 85756. These include 46 neighborhoods, comprised of 38 Neighborhood Associations (NAs), 3 Homeowner Associations (HAs), 4 neighborhoods with no NAs or HAs, and the City of South Tucson.

MAP OF ZIP CODES SURVEYED



SURVEY QUESTIONS AND OVERALL RESPONSES BY QUESTION

Question 1) The F-16, F-18,[1] F-22,[1] and F-35 are considered high-risk fighters, because these single-engine jets have no backup engines, as compared to the A-10 fighter, which has two engines. All five fighters have a single seat, so there is no backup pilot. The majority of current flights over Tucson are by A-10s. F-16s fly over Tucson regularly, but less frequently.

A) Given this information about risk, do you support or oppose replacement of the jets that now regularly fly over Tucson from Davis-Monthan, with the F-18s, F-22s, and F-35s described above?

Total responses: 563 **54% oppose** **45% support**

B) Given this information about risk, do you support or oppose the Air National Guard replacing the jets (that now regularly depart from Tucson International Airport and fly over Tucson and the Tucson Mountains) with the F-18s, F-22s, and F-35s described above?

Total responses: 555 **53% oppose** **46% support**

Question 2) According to Air Force data[1], the F-35 is 8 times louder than the A-10, and nearly 4 times louder than the F-16. Noise generated by the F-35 will cover more than 4 times the area currently affected by over-flights. F-18s, and F-22s are 3 to 4 times louder than the A-10. These noise comparisons are for over-flights 2,000 ft. above the ground, the level of the jets as they fly over midtown Tucson neighborhoods.

A) Given this information about noise, do you support or oppose the Air Force replacing the jets that now regularly fly over Tucson from Davis-Monthan, with the F-18s, F-22s, and F-35s described above?

Total responses: 567 57%) oppose 43% support

B) Given this information about noise, do you support or oppose the Air National Guard replacing the jets (that now regularly depart from Tucson International Airport, and fly over Tucson and the Tucson Mountains) with the F-18s, F-22s, and F-35s described above?

Total responses: 562 56% oppose 44%) support

Question 3) If the types of military aircraft flying over the city and county, and the frequency of flights remain the same as now, do you support or oppose Davis-Monthan Base remaining open?

Total responses: 560 17% oppose 83% support

Question 4) If the F-18, F-22, and/or F-35 jets described in questions one and two, replace the current types of military aircraft flying over the city, do you support or oppose Davis-Monthan Base remaining open?

Total responses: 562 41% oppose 59% support

Question 5) Converting a conventional Air Force Base to an urban-friendly base has succeeded elsewhere (e.g. Ames AFB in CA) by switching to on-the-ground operations. On-the-ground operations could include: simulator training, regional coordination, remote guidance, and collaborative research with the University, Raytheon and other high tech industries such as solar, and other alternative energy.

A) Do you support or oppose limiting new operations and expansion of existing operations at Davis-Monthan, to operations that do not increase the types of planes, flight frequency, or noise from military jets over Tucson?

Total responses: 556 36% oppose 63% support

B) Do you support or oppose limiting new operations and expansion of existing operations at Air National Guard at Tucson International Airport, to operations that do not increase the types of planes, flight frequency, or noise from military jets over Tucson?

Total responses: 547 37% oppose 63% support

Question 6) Davis-Monthan's economic analysis for 2012 shows that its direct contribution was 2.6% of Tucson's economy (Tucson's Gross Domestic Product). By comparison, according to the U.S. Dept. of Commerce, Tourism made a direct contribution of 4.6% to Tucson's economy in 2012. **Were you previously aware of these facts?**

Total responses: 554 66% No 34% Yes

1. According to Air Force data (Table E-2 of the Eglin Air Force Base Environmental Impact Statement and the "ACFT dB Level" provided by Davis-Monthan AFB):

* F-35s are 8 times louder than A-10s (the majority of our current flyovers). A-10s are based at Davis-Monthan AFB.
* The F-35 is nearly 4 times louder than the F-16 (the loudest fighters regularly flying over Tucson). F-16s are under the Air National Guard, and based at Tucson International Airport.
* The noise generated by the F-35 will be spread over more than 4 times the area currently affected by over-flights, and will have 50 times the physical energy.
* F-18s and F-22s are respectively 3 to 4 times louder than the A-10, and are proposed for basing at Davis-Monthan.

(The above comparisons are for flyovers at an altitude of 2,000 feet from the ground... representative of what most Midtown Tucson neighborhoods experience).

1. Correction: In the wording of the questions dealing with risk factors (1-A and 1-B), the F-18 and F-22 were mistakenly described as single-seat, single-engine fighters, when they are actually single-seat twin-engine fighters.

RESPONSES BY ZIP CODE

TABLE OF RESPONSES BY ZIP CODE IN PERCENTAGES

	Regarding Risk D-M	ANG	Regarding Noise D-M	ANG	D-M w/o Flyover Expansion	D-M With Flyover Expansion	Limits on D-M	Limits on ANG	Prior Economic Awareness
Zip code	Q 1A	Q 1B	Q 2A	Q 2B	Q 3	Q 4	Q 5A	Q 5B	Q 6
85706 O	67.1	70	66.2	67.6	23.5	47.1	35.2	35.7	N=71.8
S	32.8	30	33.8	32.4	76.5	52.9	64.8	64.3	Y=28.2
85711 O	51.1	55.6	55.6	48.9	10.4	29.8	46.8	40.4	N=58.1
S	48.9	46.8	46.8	51.5	89.6	70.2	53.2	59.6	Y=41.9
85713 O	50.9	56.3	58.9	56.3	12.2	33.9	38.1	36.5	N=63
S	49.1	45.4	41.3	43.6	85.9	66.1	61.8	63.5	Y=37
85716 O	62.2	59.5	68.4	63.2	21.1	44.7	34.3	38.9	N=72.2
S	37.8	40.5	31.6	36.8	78.9	55.3	65.7	61.1	Y=27.8
85719 O	63.2	63.2	68.4	66.8	16.2	57.9	13.5	26.3	N=68.4
S	36.8	36.8	31.6	34.2	83.8	42.1	86.5	73.7	Y=31.6
85745 O	37.7	38.8	37.7	40.3	16.2	33.8	46.3	46.9	N=73.1
S	62.3	61.2	62.3	59.7	83.8	66.2	53.7	53.1	Y=26.9
All Surveys									
O	54.4	53.2	56.6	55.9	17.1	41.4	36.5	36.9	N=66.4
S	45.5	46.8	43.4	44.1	82.9	58.6	63.5	63.0	Y=33.6

Highest number in column coded O (oppose) is shaded yellow

Highest number in column coded S (support) is shaded blue

INTERPRETATIONS

RESPONSES BY ZIP CODE

There is a great deal of variation in responses among the different zip codes (please see the table above). This variation is likely due to numerous factors, some of which are noted below.

85706:
This zip code returned the largest number of survey responses, suggesting strong interest in the topic. This is not surprising, since its East boundary is D-M, and its South boundary abuts TIA where the ANG runway is located. It extends west to I-19, and north to Irvington.

Respondents from this zip code are strongly opposed to replacing the current fighters flying out of D-M (60%) and even more strongly opposed to the replacement of the ANG fighters flying out of TIA (70%).

This zip code is the only one that showed a slightly stronger opposition regarding risk than noise: for ANG flights (70% re risk, 68% re noise) for D-M flights, (67% re risk, 66% re noise).

Approximately 77% of this zip code support keeping the base open with current fighters and current levels of flight operations. But support drops to 53% of its respondents (a 24-point drop) if D-M brings in noisier, riskier fighters.

Respondents in this zip code strongly support limiting operations to maintaining status quo for D-M (65%) and for ANG (64%).

Seventy two percent (72%) of respondents report not previously being aware of the much larger direct economic contribution of the tourism industry to Tucson (4.6% of GDP), as compared to that of Davis-Monthan (2.6% of GDP).

The 85706 zip code is 82% Hispanic and 12% White, and the estimated average household income is $29,883.

85711:
This zip code lies just north of Davis-Monthan AFB, stretching from Golf Links/D-M up to Speedway, and from Wilmot to Alvernon Way. It has the largest number of active military as residents (almost one and a half times more than the participating zip code with the next highest number).

This may be a factor in why this zip code (of the participating zip codes) was the most supportive in keeping the base open with the current levels of flight operations (90%) and why it was still strongly supportive of keeping the base open even with the noisier jets (70%).

Despite this support, 51% of its respondents were opposed to changing the D-M fighters due to risk, and 56% were opposed due to noise. In addition, 56% were opposed to changing the ANG fighters due to risk, and 49% opposed it due to noise.

There was also a notable 20-point drop in their support for D-M with introduction of the noisier fighters, and 53% supported limits on operations at D-M to maintain status quo, and 60% supported limits to sustain status quo on operations at ANG.

In this zip code, 60% of respondents report no prior awareness of the direct contribution of the tourism industry to Tucson's economy, as compared to the direct contribution of Davis-Monthan.

The 85711 zip code is 51% White and 36% Hispanic, and the estimated average household income is $36,189.

85713:
This zip code is bounded on its north by 22nd St. and on its south by Ajo Way. It runs from Alvernon Way to the intersection of Gates Pass and Kinney Rd. on the west side of the Tucson Mountains.

Its respondents were opposed to changes in jet fighter planes from D-M or ANG with regard to noise (59% and 56% respectively). However, with regard to risk, they were less opposed to changes in D-M flights than ANG flights (51% and 56% respectively).

These respondents were 86% supportive of D-M with current flight operation levels, but support drops to 66% with AF expansion plans (a 20-point drop).

Zip code 85713 respondents strongly support limits on D-M and ANG operations (62% and 64% respectively) to maintain status quo.

Sixty three percent (63%) of respondents report no prior awareness of the direct contribution of the tourism industry to Tucson's economy, as compared to Davis-Monthan's direct contribution.

Zip code 85713 is 68 % Hispanic and 22% White, and the average household income is $31,992.

85716:
This zip code is located North of D-M and TIA, running from 22nd up to the Rillito River/Prince Rd. area, between Alvernon Way and Tucson Blvd.

Respondents from this zip code were strongly opposed to changes in fighter jets at D-M and ANG based on risk (62% and 60% respectively). This opposition is even stronger with regard to noise (68% and 63% respectively).

While 79% are supportive of D-M with no changes in flight operations, support drops to 55% if AF expansion plans are implemented (a 24-point drop).

There is strong support for operational limits on D-M and ANG (66% and 61% respectively) in order to maintain status quo.

Seventy two percent (72%) of respondents from this zip code report no prior awareness of the direct contribution of the tourism industry to Tucson's economy, as compared to Davis-Monthan's direct contribution.

This zip code is 62% White and 26% Hispanic. The average household income is $32,370.

85719:
This zip code is located to the northwest of D-M and TIA, running from 22nd up to the Rillito River/Wetmore area, between Tucson Blvd. and Euclid Ave.

Respondents were strongly opposed to changes in D-M fighter jets (63% due to risk, and 63% due to noise). They were even more strongly opposed to changes in ANG fighters (68% due to risk, and 67% due to noise).

Eighty four percent (84%) of its respondents are supportive of keeping D-M open with current levels of flight operations.

However, there is a dramatic switch from support to opposition, if the noisier, riskier fighter jets are brought in. The AF's planned expansion results in 58% of respondents opposing keeping D-M open (a drop of 42 points).

There is very strong support from respondents of this zip code for limiting expansion of D-M and ANG operations (87% and 74% respectively) in order to maintain status quo.

Sixty eight percent (68%) of respondents from this zip code report no prior awareness of the direct contribution of the tourism industry to Tucson's economy, as compared to Davis-Monthan's direct contribution.

The 85719 zip code is 62% White and 24% Hispanic, and the estimated average household income is $29,298.

85745:
This zip code includes the farthest northwest portion of the city, and a very large area outside the city limits, extending well past the Tucson Mountains to the west.

About 62% of responses from this zip code are supportive of jet fighters from D-M and ANG flying over the city. This may be due (in part) to the fact that the largest portion of this zip code does not lie within the city.

Roughly 84% of responses from zip code 85745 are supportive of D-M with current flyover levels and current fighters.

However, with implementation of the AF's planned expansion, support for D-M drops to 66% (an 18-point drop).

Consistent with that, about 53% of these respondents support limiting D-M and ANG to operations that will not expand overflights and will not increase the noise from overflights.

Seventy three percent (73%) of respondents from 85745 report no prior awareness of the comparative contributions of the tourism industry and Davis-Monthan, to Tucson's economy.

The 85745 zip code is 50% Hispanic and 40 % White, and the estimated average household income is $49,662, substantially higher than any of the other zip codes.

CONCLUSION

In the Tucson Metro area there is opposition to Air Force plans to replace current aircraft with noisier, riskier fighters at Davis Monthan Air Force Base and at the Air National Guard (ANG), which flies out of a runway adjacent to the Tucson International Airport (TIA).

Support for Davis-Monthan Air Force Base is greatly decreased (up to 42 percentage points in zip code 85719) by the prospect of louder, riskier fighters replacing current aircraft that fly out of Davis-Monthan. The degree of opposition varies depending on location. Possible reasons for the variation are: proximity to flight paths, number of active or retired military residents in an area, and number of people living in the area who work for the base.

There is strong support for limiting expansion of flight operations at Davis-Monthan Air Force Base and the Air National Guard, in order to prevent bringing in F-18, F-22, and F-35 jet fighters, and to prevent any increase in flight frequency, or noise from military jets over Tucson.

A clear majority of respondents (66%) were unaware of the much larger direct economic contribution of the tourism industry to Tucson (4.6% of GDP), as compared to that of Davis-Monthan (2.6% of GDP) and that knowledge varied from 58% to 73% depending on location.

CHARTS

COMPARISON OF TUCSON FORWARD AND SADA SURVEYS

* TFI: The survey was mailed to a computer-generated random selection[2] of 4,000 residents from the 29,093 single-family residential dwellings in the targeted Tucson zip codes. Of those, 571 responses were received (1.96% of the targeted population).

* SADA: The survey sample size was 617, and the target population is all of Southern Arizona, which the census bureau states is a population of approximately 1.8 million. So the SADA responses were only (0.03%) of their targeted population.

* TFI: The survey specifically included the Tucson neighborhoods currently most affected, and those likely to become affected if AF plans for flight expansion are implemented.

* SADA: In the list of participating zip codes published by SADA, none are within the City Limits of Tucson. The results of the SADA survey are highly skewed by the inclusion of all of Southern Arizona, with no evidence of a valid poll of the residents most affected by overflights (i.e., those living within the City of Tucson).

* TFI: All participating zip codes are listed, and are zip codes for the City of Tucson.

* SADA: There are no zip codes or major cross streets given for the subset of 103 participants, who, without producing any substantiation, SADA asserts live near Davis-Monthan or Tucson International Airport.

* TFI: There was uniformity of method and time frame for the survey across all participants.

* SADA: There were different methods and time frames for subsets of participants.

* TFI: A standard, valid method of mail-out- survey was utilized to minimize exclusion of lower economic households, which may not have access to a computer and also to ensure an acceptable geographic distribution of respondents.

SADA: The type of survey SADA describes as an intercept survey (which was administered to the subset of 103 participants at a later date) carries no validity as representative of the area supposedly targeted.

TFI: The questions allow participants to voice concerns about overflights separate from support for the airbases themselves.

SADA: Survey questions were very broad and encompassing. In order to object to overflights, participants had to object to all military bases in Southern Arizona.

TFI: Survey questions allowed residents to voice their feelings about the current level of overflights separate from feelings about AF plans to increase overflights. Because we wanted to survey the opinions of Tucson residents when they have accurate information on which to base their opinions, as opposed to misinformation or lack of information, we included background information about the AF plans for increased overflights, the aircraft they plan to bring here, and the economic contribution of D-M compared to that of tourism.

This was done to give respondents a valid basis for informed opinions.

SADA: The survey did not address, or disclose the Air Force's planned increase in overflights and did not address bringing the F-35 to Tucson. They also did not explain that the F-35 is noisier than current jets regularly flying over Tucson. Instead the survey asked only how participants felt about having the F-35 in Southern Arizona (which is a very large area comprised mostly of open desert, including the completely unpopulated Goldwater Air Force Range).

So answers to this question are not at all indicative of how Tucson residents would feel about having a fleet of F-35s regularly flying over the homes, yards, parks schools, clinics, churches, restaurants, hotels, etc. of central Tucson.

2. The random selection of 4,000 residents from the 29,093 single-family residential dwellings in the area targeted, was done online via *Research Randomizer:* http://www.randomizer.org/form.htm

Website for Tucson Forward, Inc. is: **tucsonforward.com**

COMPARISON OF TUCSON FORWARD AND SADA SURVEYS

* TFI: The survey was mailed to a computer-generated random selection[2] of 4,000 residents from the 29,093 single-family residential dwellings in the targeted Tucson zip codes. Of those, 571 responses were received (1.96% of the targeted population).

* SADA: The survey sample size was 617, and the target population is all of Southern Arizona, which the census bureau states is a population of approximately 1.8 million. So the SADA responses were only (0.03%) of their targeted population.

* TFI: The survey specifically included the Tucson neighborhoods currently most affected, and those likely to become affected if AF plans for flight expansion are implemented.

* SADA: In the list of participating zip codes published by SADA, none are within the City Limits of Tucson. The results of the SADA survey are highly skewed by the inclusion of all of Southern Arizona, with no evidence of a valid poll of the residents most affected by overflights (i.e., those living within the City of Tucson).

* TFI: All participating zip codes are listed, and are zip codes for the City of Tucson.

* SADA: There are no zip codes or major cross streets given for the subset of 103 participants, who, without producing any substantiation, SADA asserts live near Davis-Monthan or Tucson International Airport.

* TFI: There was uniformity of method and time frame for the survey across all participants.

* SADA: There were different methods and time frames for subsets of participants.

* TFI: A standard, valid method of mail-out- survey was utilized to minimize exclusion of lower economic households, which may not have access to a computer and also to ensure an acceptable geographic distribution of respondents.

SADA: The type of survey SADA describes as an intercept survey (which was administered to the subset of 103 participants at a later date) carries no validity as representative of the area supposedly targeted.

TFI: The questions allow participants to voice concerns about overflights separate from support for the airbases themselves.

SADA: Survey questions were very broad and encompassing. In order to object to overflights, participants had to object to all military bases in Southern Arizona.

TFI: Survey questions allowed residents to voice their feelings about the current level of overflights separate from feelings about AF plans to increase overflights. Because we wanted to survey the opinions of Tucson residents when they have accurate information on which to base their opinions, as opposed to misinformation or lack of information, we included background information about the AF plans for increased overflights, the aircraft they plan to bring here, and the economic contribution of D-M compared to that of tourism.

This was done to give respondents a valid basis for informed opinions.

SADA: The survey did not address, or disclose the Air Force's planned increase in overflights and did not address bringing the F-35 to Tucson. They also did not explain that the F-35 is noisier than current jets regularly flying over Tucson. Instead the survey asked only how participants felt about having the F-35 in Southern Arizona (which is a very large area comprised mostly of open desert, including the completely unpopulated Goldwater Air Force Range).

So answers to this question are not at all indicative of how Tucson residents would feel about having a fleet of F-35s regularly flying over the homes, yards, parks schools, clinics, churches, restaurants, hotels, etc. of central Tucson.

2. The random selection of 4,000 residents from the 29,093 single-family residential dwellings in the area targeted, was done online via *Research Randomizer:* http://www.randomizer.org/form.htm

Website for Tucson Forward, Inc. is: tucsonforward.com

FOR IMMEDIATE RELEASE:

Date: Mon. 11/10/14

A TUCSON FORWARD SURVEY OF 17 TUCSON ZIP CODES SHOWS STRONG SUPPORT (63%) FOR LIMITING MILITARY FLIGHTS OVER THE CITY, revealing lack of public confidence in the Air Force Draft Environmental Assessment (DEA) with its highly controversial "Finding of No Significant Impact". The DEA claims that there will be no significant impact on Tucson from the increased overflights and the much louder, riskier jets the Air Force (AF) plans to fly over Tucson.

DEADLINE FOR PUBLIC COMMENT ON THE AF DRAFT ENVIRONMENTAL ASSESSMENT IS NOVEMBER 24TH. Public should email comments to: 355fw.pa.comment@us.af.mil

TUCSON FORWARD, INC. (TFI) ("Background/History" attached) is releasing the results of its extensive, in-depth survey of 17 Tucson zip codes containing the 46 neighborhoods most heavily impacted by military overflights from Davis-Monthan and from the Air National Guard (which flies out of a runway adjacent to Tucson International Airport).

The survey was designed and conducted specifically to determine the level of support or opposition of residents under (or near) military flight paths, regarding the Air Force's plan to increase the number of overflights, and to bring in louder, riskier jet fighters, to fly over the most densely populated areas of Tucson.

Survey results (see first attachment) show lack of public confidence in Air Force claims that there will be "No Significant Impact". It also contradicts SADA survey claims that even Tucson residents who live close to Davis Monthan and the Air National Guard (ANG) at Tucson International Airport (TIA) have no serious concerns about increased in frequency, risk, or noise from military overflights. The TFI survey contradicts SADA claims that the public supports bringing the F-35 here. According to the Air Force's own estimates, the F-35 is at least 4 times louder than any jets flown over Tucson to date.

TFI SURVEY RESULTS:
(See 3 attachments for full survey analysis, info regarding the AF DEA, & survey comparisons)

*** A majority (53 to 57%) of respondents are opposed to overflights by louder, riskier jet fighters from D-M, and 56% oppose louder, riskier jets out of ANG at TIA.**

*** While there is strong support for D-M with current levels of overflights and current aircraft, support dramatically decreases by 53% (24 percentage points), with the prospect of the Air Force plan for Davis-Monthan to host louder, riskier jets.**

*** There is strong support (63%) for limiting overflight operations to those operations currently in place at D-M and ANG.**

*** A clear majority of respondents (66%) were unaware of the much larger direct economic contribution of the tourism industry to Tucson (4.6% of GDP), as compared to that of Davis-Monthan (2.6% of GDP).**

CONTACTS:

Mary Schiltz, TFI President: 326-0140 < MARYadvocacy@msn.com>
Lee Stanfield, TFI Board Member: 256-4058 <simplee@cox.net>
http://tucsonforward.com/

ZIP CODE INFORMATION REGARDING TFI SURVEY

We limited the survey to single-family residential dwellings in neighborhoods most effected by military overflights. If a zip code did not contain any neighborhood which was under or near one or more regular military flight paths, it was not included in the survey. We did not survey the following zip codes for the reasons given below:

85707 & 85708 are PO Boxes for D-MAFB

85709 is a PO Box for Pima Community College

85717, 85721 & 85722 are PO Boxes for the UA

85718 lies outside of Tucson, and is not near regular military flight paths

85723 is a PO Box for the VA Hospital

85724 is a PO Box for UMC

85757 lies outside of Tucson

85710, 85747, and 85748 are not near regular military flight paths

Tucson Forward Survey Clarification Notes:

*** Clarification regarding the first statement of the Executive Summary:**

Of all the responses to AF plans to bring in louder, riskier planes at D-M and ANG, 53% was the lowest percentage opposed, and 57% was the highest percentage opposed. So the responses spanned from 53% to 57%.... a span of 4 percentage points. The 53% was in response to risk regarding planes flying out of ANG, and the 57% was in response to noise regarding planes flying out of D-M.

*** Regarding the confidence level/margin of error:**

Within a 99% confidence level, each answer in this TFI survey is +/- four (4) percentage points, if extrapolated to the entire targeted population of 29,093 single-family residential dwellings in the neighborhoods most impacted by current or proposed military overflights.

TUCSON FORWARD, INC. http://tucsonforward.com/ is a non-partisan, diverse group of over 600 forward-thinking residents of the city of Tucson whose backgrounds include small business owners, real estate developers, doctors, lawyers, educators, community and neighborhood leaders, students, and retirees.

We are very concerned that Air Force plans to bring in much louder, riskier jet fighters, and significantly increase the number and frequency of military flights over Tucson, could seriously damage our revitalization project of downtown, our large tourism/hospitality industry, and the property values, health, and quality of life of residents of the central area of Tucson, and thus decrease city revenue and the economy of the entire valley.

BACKGROUND/HISTORY:

Over the past 35 years, the AF has repeatedly expanded the flight operations over Tucson without complying with the National Environmental Policy Act (NEPA), which requires that before any expansion of operations, an Environmental Assessment (EA) must be conducted to determine if there is a possibility of any negative impact on the environment (including humans and their properties).

If the EA indicates that there may be a negative impact, then a more in-depth Environmental Impact Study (EIS) must be conducted, and all possible impacts must be determined and disclosed to the public, and action must be taken to eliminate (or at a minimum) alleviate those impacts.

Yet the last EA for Operation Snowbird was in 1978, despite the fact that it brings in jet fighters to fly over densely populated central Tucson, and has undergone enormous expansion since then.

CURRENT ISSUE:

After decades of complaints from Tucson residents about the ever-increasing overflights and louder jets, the AF has finally conducted an EA. However, they have used grossly inappropriate tools to measure such things as noise from overflights and the effects of increased noise on: hearing, other aspects of physical and emotional health, property values, and structural integrity of residences and other buildings.

This has led to an inadequate Environmental Assessment, and the surprising claim that increasing the number of flights and flying louder, riskier jets over Tucson will have "No Significant Impact" on the residents

or environment of Tucson.
NEPA requires that there be a public comment period for the EA to allow the public a chance to voice any concerns about the plans for expansion. The comment period for this EA is set to end Nov. 24th. We are concerned, because our city officials and the media and press have not brought the issue to the public's attention, and instead, have allowed several misconceptions about Davis-Monthan and the Air Force to be viewed as facts, in the minds of the public.

Therefore, we are attempting to make sure that the entire Tucson public is made aware of all the facts regarding the expansion plans, so they can make informed comments to the Air Force, and voice their concerns.

Recently, the Southern Arizona Defense Alliance (SADA) published a document they call the SADA Community Survey, which claims that residents of Tucson (even those living close to Davis-Monthan and the Air National Guard runway out of Tucson International Airport) are so supportive of the bases, that they do not mind louder fighters flying over Tucson.... even the F-35 (which is the loudest fighter ever built, and which will come here under Operation Snowbird if the F-35 replaces all other jet fighters as the Air Force plans).

Therefore, Tucson Forward, Inc. (TFI) has just completed a survey specifically designed to determine the views of residents in 17 Tucson zip codes containing the 46 neighborhoods most heavily impacted by the military overflights from Davis-Monthan (D-M) and the Air National Guard (which flies out of Tucson International Airport).

In sharp contrast to the SADA conclusions, the TFI survey has found that a majority of respondents are opposed to both the elevated noise and risk of an increase in overflights by louder and riskier jet fighters.

Additionally, the TFI survey identifies a solution to the threat of D-M closure, and reveals 63% support of this solution by residents in all areas surveyed.

The solution is to convert Davis-Monthan to an urban-friendly base by switching to on-the-ground operations, such as: regional coordination command center, simulator training, remote guidance, and collaborative research with the University, Raytheon and other high tech industries (for example, solar, and other alternative energies), while limiting in-the-air flight operations to current levels.

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 11:04 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: ATTN: TFT EA COMMENT SUBMITTAL

From: brian dwyer [mailto:dwyeranalytics@gmail.com]
Sent: Monday, November 24, 2014 9:15 AM
To: 355 FW/PA Comments
Subject: ATTN: TFT EA COMMENT SUBMITTAL

To whom it may concern,

Thank you for allowing me the opportunity to review and comment on the Draft EA. I would like to start with saying that I disagree with the findings and believe that the increased flights will cause even more damage to Tucson, Pima county and the people that live here than the current incessant military overflights already do. I find the Draft EA extremely deficient and inaccurate in the areas below:

1) 1) The EA falsely claims on page 4 lines 29-34 that there have been no Class A mishaps since 1978 related to DMAFB. I find this particularly disturbing since a simple web search shows that in the only the last 20 years there have been at least 10 Class A accidents resulting in loss of life and complete destruction of the aircraft. Some of these accidents occurred for unknown reasons and thus could happen anywhere or anytime in the city or county along the aircraft's flight path. It is perplexing that the analysis has chosen to completely ignore these. All of these incidents involved military aircraft and would presumably be even more likely to occur when trainees are involved flying even more dangerous aircraft, and there are probably many more that I was unable to locate information about but the Air Force surely has that information available. These incidents and all others that have been left out should be considered. These incidents are listed below:

a. 7/27/1982 USAF F-5b and F-5F collide over Tucson. All three creq eject.http://en.wikipedia.org/wiki/List_of_accidents_and_incidents_involving_military_aircraft_%281980%E2%80%9389%29

b. 2003 training ANG F16 crashes into electrical wires and poles causing more damage to civilian vehicles. These are the same trainings that are being considered in the EA http://usaf.aib.law.af.mil/ExecSum2003/F-16B_Tucson_25Sep03.pdf

c. 3/14/1989 USAF CH-3E helicopter crashed and killed all 15 passengers. 20 miles northwest of Tucson. Again cause unknown and could have happened anywhere.

http://www.nytimes.com/1989/03/14/us/helicopter-crash-kills-15-in-arizona.html

d. 4/9/2000 military helicopter crashes and kills all 19 passengers in Marana, AZ. The cause was "human error" and could have happened anywhere. Low flying helicopters are also part of the training exercises.
http://tucsoncitizen.com/morgue2/2000/07/27/82889-human-error-blamed-in-osprey-crash/

e. 2002 Two A10's from DMAFB crash into each other
http://usaf.aib.law.af.mil/ExecSum2002/A-10A%282%29_DouglasAZ_17Jan02.pdf

f. The following 5 incidents are sourced from
http://tucsoncitizen.com/morgue2/2002/01/18/116932-no-cause-in-fatal-a-10-crash/

g. 1999 A10 does belly landing crash on DMAFB runway

h. 5/1998 A10 crashes into hillside southwest of Kitt Peak

i. 1997 A10 pilot from DMAFB commits suicide by crashing into mountain

j. 1997 A10 from DMAFB crashes at Goldwater range

k. 1984 Maj. Rayhill was killed when his A-10 crashed during a training missing southwest of Tucson

2) 2) The EA should mention all accidents not only Class A. Many smaller accidents disrupt and stress the lives of everyone living near the base. There are probably many historical incidents that are difficult for the public to find. I have included two recent ones below.

a. The EA did not mention that in 4/13/2012 a Thunderbird pilot from DMAFB caused a sonic boom that caused over $22,000 in damage to many(100+?) local homes and businesses. This was due to pilot error. Trainees will presumably have more errors.
http://archive.airforcetimes.com/article/20121219/NEWS/212190304/Thunderbird-sonic-boom-caused-22K-damages

b. 9/30/2014 An A10 from Davis-Monthan Air Force base malfunctioned and needed to perform a belly crash landing.
http://www.tucsonnewsnow.com/story/26660859/a-10-makes-hard-landing-at-davis-monthan

3) 3) Since under the proposed changes new more dangerous, single engine aircraft would be training out of Davis-Monthan the EA should consider Class A mishaps from other similar installations that train single engine aircraft, such as the F-16's training at Luke Air Force Base. There have been 18 Class A mishaps with the F-16's stationed at Luke Air Force Base in only the last 14 years. The training conditions at Luke Air Force base in Phoenix are very similar to those in Tucson. In Tucson such Class A mishaps are far more dangerous since DMAFB is surrounded by a large metropolitan area. http://usaf.aib.law.af.mil/

4) 4) The EA states that the F-22 would be involved in new training missions. Even many of the Air Force's own pilots are afraid to fly the F-22 and it is known to have many issues. The Draft EA makes no mention of safety issues related to the F-22 that would be flying over a metropolitan area.

5) 5) The Draft EA uses an unacceptable baseline. The Air Force continually uses newer, louder baselines and then says that increased overflights are only a small increase over the baseline. Using this false logic they can increase the noise level each year by 6% simply by changing their baseline to the previous year. That makes no logical sense. For example, using this logic they could increase the flight and noise level by 6% a year every year for 5 years, each increase would be considered a FONSI, yet the cumulative effect would be an increase of 30%! That does not make sense to anyone but that is essentially what the Draft EA analysis has done by using 2009 as the baseline year. A fixed baseline year should be used for all past and future analyses and that baseline year should be 1978.

6) 6) The Draft EA continually makes mention that the increase is only 6% of the total operations, but fails to state that this 6% of sorties consists of aircraft that are significantly louder than most of the aircraft in existing operations so may actually increase noise levels by some much higher percent like 30%,40%, or maybe even 100%.

7) 7) The use of Day/Night Average Sound Levels is very misleading. Actual noise should be measured by the number of incidents and maximum volume. Continual repeated loud noise disturbances should not be averaged away over time. A sound can be loud enough to damage a person's hearing but when you average it across a year it is negligible. Even the Air Force does not use DNL to measure unsafe noise levels for its own personnel, they use SEL. Civilians should be treated as well and SEL measurements should be used for environmental noise impacts

8) 8) The draft EA does not provide analysis of increased noise and safety issues along entire flight paths. It concentrates on areas around DMAFB. Also, military flights here often fly outside of flight paths and disturb everyone even in areas that are not flight paths or overlays. There is no analysis of any of these areas and this analysis should be added.

9) 9) The Draft EA does not take into account the inevitable costs of lawsuits against the Air Force for loss of life or damage to property, or the incalculable loss of trust in an Air Force that is inconsiderate to the needs of

the people that live around it. The City of Tucson and Pima County have already rezoned existing, populated neighborhoods in Tucson to be “incompatible with human occupation”. The people who suffer now living in these areas and watching their property values collapse have great misgivings about the Air Force. How is this cost to the Air Force’s reputation measured?

1010) Claim that property values are not diminished on Page 4 lines 16-27 seem very false. The property values surrounding Davis-Monthan and TIA are extremely low compared to the rest of Tucson, and are directly attributable to noise and due to being rezoned as “incompatible with human occupation” due to Davis-Monthan overflights

1111) On page 3-16 the draft EA states that tourism is the most important industry in Tucson contributing $2.4 billion annually. Tourists come to Tucson to enjoy outdoor activities and the beautiful natural environment. Over the past few years this beautiful environment has been seriously degraded due to F-16 overflights. Currently F-16 fly over and disrupt the beauty of many famous tourist sites in the area such as the internationally famous Sonoran Desert Museum, the hiking trails of the Tucson Mountains, Sabino Canyon, and Gates Pass. Tourists come here to witness the solitude and beauty of the desert not listen to F-16 and helicopters blaring above them. The noise that they create has also destroyed the largest municipal park in Tucson, Reid Park. I find it ridiculous to claim that there will be no effect by increasing flights of noisier military aircraft over these areas, and even more ridiculous to say that it will have a positive effect. Under the pre-2000, 1978, baselines military sorties were not so numerous did not have such degrading impact on Tucson’s most important eco-tourism industry.

DMAFB and ANG located at Tucson International Airport are located in a major metropolitan area and the noise that they create in Tucson and Pima county has already exceeded any reasonable level. Adding additional sorties and training will cause even more grief and suffering for those people that live in the effected areas. If the Air Force wishes to expand operations at these bases then they should only assign future missions that are more compatible with being located in a major metropolitan area. Only in that way will they gain the respect and support of the people of Tucson and Pima county.

Thank you for your time and consideration,

From:	355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent:	Tuesday, November 25, 2014 8:48 AM
To:	CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc:	FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject:	2014 TFT COMMENTS FW: ATTN: TFT EA Comment Submittal
Attachments:	TFT Cmmt Substantive Comments.doc; TFT Cmmt DNL.doc; TFT Cmmt Loud Aircraft.doc; TFT Cmmt Noise Analysis.doc; TFT Cmmt Schultz Curve.doc; TFT Cmmt DNL & Annoyance Response 2.doc; TFT Cmmt Deficiencies in Noise Analysis.doc; TFT Cmmt Intermittent Operations 2.doc; TFT Cmmt Impacts Outside 65 DNL.doc; TFT Cmmt Cumulative Impacts.doc; TFT Cmmt Students.doc; TFT Cmmt Health.doc; TFT Cmmt Prop Values Arcft Noise.doc; TFT Cmmt Prop Values Comps.doc; TFT Cmmt Prop Values.doc; TFT Cmmt Verify Noisemap.doc

From: gary hunter [mailto:garyahunter@gmail.com]
Sent: Monday, November 24, 2014 4:39 PM
To: 355 FW/PA Comments
Subject: ATTN: TFT EA Comment Submittal

Dear sirs:

Attached are sixteen letters that comment on the TFT EA. Hard copies of the letters are being submitted via U.S. Mail.

All of us appreciate the opportunity to provide input on the EA.

Gary Hunter

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Cumulative Impacts

Dear sirs,

The Council on Environmental Quality, in the first paragraph of the Introduction to a comprehensive publication on cumulative effects, states

> Evidence is increasing that the most devastating environmental effects may result not from the direct effects of a particular action, but from the combination of individually minor effects of multiple actions over time [*Considering Cumulative Effects under the National Environmental Policy Act* (U.S. Council on Environmental Quality, 2009)].

The incremental impact of an action may not in itself be significant. However, the incremental impact, taken together with the incremental impacts of other actions, may create very substantial consequences to the environment. The sum of the incremental impacts may be significant.

This is why the TFT EA is required to analyze the cumulative effects of *all* impacts, even though some incremental impacts may appear to be insignificant.

40 CFR 1508.7 defines *cumulative impact* as

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The EA's analysis of cumulative impacts is deficient. It fails to adequately consider the impacts of past actions and of reasonably foreseeable future actions, and it fails to adequately consider the impacts created by other governmental and non-governmental entities.

The EA provides no quantitative analysis of the cumulative impacts.

For impacts due directly to activities of the Total Force Training Mission, careful analysis of past and current impacts is crucial. The impacts of Operation Snowbird (OSB) have not been assessed since 1978; the impacts of the Multi-Service and the Foreign Military operations have never been assessed.

If the Air Force were to decide upon the No Action Alternative of the TFT EA, the three TFT components will (with the exception of the 1978 OSB EIS) continue to function with absolutely no environmental assessment of their operations. If the Air Force were to decide upon either of the other two alternatives, the three components will (with the exception of the 1978 OSB EIS) function with environmental assessments only of their operations that exceed 2009 levels.

Scrupulous analysis of TFT's past and current environmental impacts, therefore, is imperative.

(Page 1-11 of the TFT EA states, "The No Action Alternative addresses the impacts of continuing the exercises at the 2009 levels of sorties." That statement is not correct; the No Action Alternative merely provides brief narrative descriptions of baseline conditions, with no analysis of their impacts. Page 1-11 also states, "The 2002 CSAR EA did include tangential analysis of the OSB aircraft." Neither is that statement correct; OSB is not mentioned once in the 398 pages of the CSAR EA. Its tables 2.3-4 and 2.3-5 list several aircraft in footnotes; presumably, at least some of those aircraft are attributable to OSB, though the footnotes do not say so. Certainly, the two footnotes, along with a line for the number of "Other" sorties, do not constitute a "tangential analysis.")

Cumulative impacts must include all other past and present operations at Davis Monthan AFB. The U.S. Environmental Protection Agency makes this clear:

> The NEPA analysis should establish the magnitude and significance of cumulative impacts by comparing the environment in its naturally occurring state with the expected impacts of the proposed action when combined with the impacts of other actions. [*Consideration of Cumulative Impacts in EPA Review of NEPA Documents* (EPA, 1999); hereinafter referred to as *Consideration*.]

The phrase above, "the environment in its naturally occurring state," is illustrated by *Consideration* with an example of an agency that applies for the relicensing of a dam. During the time since the dam was built, "the affected environment has been seriously degraded for more than 50 years with accompanying declines in flows, reductions in fish stocks, habitat loss, and disruption of hydrologic functions." Without proper analysis of these cumulative impacts, *Consideration* states, the environmental analysis "would only identify the marginal environmental changes between the continued operation of the dam and the existing degraded state of the environment." Proper analysis of cumulative impacts must include all effects of the dam during the years since "the environment [was] in its naturally occurring state."

Similarly, analysis by the TFT EA of cumulative impacts must reach back to the time when "the environment [was] in its naturally occurring state." Past impacts might begin in 1927, when the City of Tucson constructed Davis Monthan airport in accordance with U.S. Army specifications, and when a military presence at the airport was initiated. Alternatively, past impacts might begin in 1941, when Davis Monthan gained its first base commander, and when Army Air Forces units were first stationed there. Past impacts might begin in 1948, when civilian operations were removed from Davis Monthan.

"The identification of the effects of past actions is critical to understanding the environmental condition of the area," *Consideration* advises. "How far back in time to consider depends on how long the resources of concern have been affected." Certainly, past impacts extend much further back in time than the EA's 2009 baseline. *Consideration* warns that "the current [baseline] condition typically may not adequately represent how actions have impacted resources in the past and present or how resources might respond to future impacts."

Past and current activities at Davis Monthan affect many aspects of the environment, including (but not limited to) noise, air pollution, groundwater pollution, demands upon public infrastructure and resources, property values, health of nearby residents, learning abilities of students, and environmental justice. In its analysis of past and present cumulative impacts, the EA must separately consider each of these aspects.

Cumulative impacts are not limited to activities at Davis Monthan. Cumulative impacts encompass all actions of all entities within the TFT Region of Influence. 40 CFR 1508.7 and *Consideration* both make this clear.

Proper analysis of cumulative impacts requires much more than a generalized narrative description. The impacts must be quantified.

"Trends analysis, or how the resource condition has changed over time, is the most useful tool for looking at the accumulated effects of past actions," *Consideration* states. Trends analysis is equally useful for looking at the effects of future actions. "The analysis should include the use of trends information and interagency analyses on a regional basis to determine the combined effects of past, present, and future actions," says *Consideration*.

Trends analysis can help determine reasonably foreseeable future actions, such as future increases in vehicular traffic in the Region of Influence, future increases in air traffic at TIA, and future population densities in the areas around Davis Monthan.

Following is one example of the importance of the analysis of the cumulative impacts of reasonably foreseeable future actions: In the past, the TFT EA Region of Influence has been out of compliance with EPA's National Ambient Air Quality Standards, and currently is classified as a maintenance area for CO and some other criteria pollutants. As vehicular traffic increases in the future, the level of CO can be expected to rise. The incremental impact of TFT's CO contribution may then push the Region of Influence out of compliance.

A quantitative analysis of reasonably foreseeable future traffic trends, and of resultant CO levels, will determine the impacts of TFT's incremental CO contribution.

The legal system has provided guidelines for the term "reasonably foreseeable future actions." According to *Consideration*, "Court decisions on this topic have generally concluded that reasonably foreseeable future actions need to be considered even if they are not specific proposals."

The TFT EA fails to carefully consider numerous reasonably foreseeable future actions from all entities within the Region of Influence. Following are two examples, both from the Air Force itself. The first is a specific proposal; the second is not, but it nevertheless falls within the courts' guideline for a "reasonably foreseeable future action."

First: The Air Force intends to eliminate all A-10s. The Air Force wants to accomplish this quickly; Congress may decide to delay it by a few years. In either case, elimination of all A-10s is a specific proposal, and is a reasonably foreseeable future action.

The A-10s will be replaced with louder aircraft; Davis Monthan's 355th FW, for example, intends to replace its A-10s with F-16s. In addition, for all three of the EA's alternatives, noise levels will increase as TFT A-10s are replaced with louder aircraft. Analysis of cumulative impacts of reasonably foreseeable future actions must include a careful assessment of the replacement of TFT and 355th A-10s.

Second: Page 5-5 of the TFT EA states, "Cumulative effects on the noise contours surrounding DMAFB and TIA are no longer expected to occur since the F-35A beddown is now proposed at Luke AFB, Arizona." In fact, Luke will receive only six F-35A training squadrons, which is the maximum it can accommodate. The Air Force expects to beddown "up to 15 or more F-35A training squadrons," according to *F-35A Training Basing Environmental Impact Statement* (U.S. Air Force, 2012), hereinafter referred to as *F-35A EIS*. The remaining approximately twelve squadrons will be distributed among Boise AGS, Holloman AFB, and Tucson AGS, states *F-35A EIS*. Boise can accommodate a maximum of three squadrons; Holloman can accommodate a maximum of five squadrons. The remaining F-35A squadrons can go no place else except Tucson. Beddown of F-35A squadrons could begin at TIA as soon as beddown is complete at Luke.

The Air Force intends to replace most fighter aircraft with F-35As. Then-current aircraft of Davis Monthan's 355th FW will be replaced with F-35As; many TFT aircraft will also be replaced with F-35s. The Air Force's intent to bring F-35As to both TIA and Davis Monthan is corroborated by a July 15, 2014, letter written by Ms. Kathleen I. Ferguson, Acting Assistant Secretary of the Air Force. Assistant Secretary Ferguson wrote, "Tucson Air Guard Station and Davis-Monthan AFB may be considered in the next round of F-35A basing, which will likely begin in the next few years."

While beddown of F-35As at TIA and Davis Monthan are not yet specific proposals, they fall within the courts' guideline for reasonably foreseeable future actions. They must be included in an analysis of cumulative impacts.

During the EA's comment period, letters are being submitted that detail certain aspects which must be considered as part of the analysis of cumulative effects. By reference, this letter is a part of each of those letters.

Analysis of each of the cumulative impacts is not satisfied by a generalized narrative; it must also include a quantitative assessment. Without careful analysis of each of the cumulative impacts, and without knowledge of the significance of their impacts, the Air Force cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, all past, present, and future cumulative impacts must be properly analyzed.

Sincerely,

Dick Barber
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Deficiencies in Noise Analysis

Dear sirs,

The EA's analysis of noise is deficient in several areas.

1) Appendix C states that, except for analysis of Visiting Units, the AICUZ electronic noise files were used "without modification (AS IS)."

- Appendix C does not explain why the files were used without modification, and why modifications might be desirable or undesirable.

- Appendix C must provide an explanation. If appropriate modification of the noise files will yield more accurate results, the noise files must be appropriately modified and the noise analysis performed again.

2) Appendix C states that, of Noisemap's three modules, only two were used for the EA's noise analysis.

- Appendix C does not explain why the third module was not used, and why its use might be desirable or undesirable.

- Appendix C must provide an explanation. If the third module, in conjunction with the others, will yield more accurate results, the noise analysis must be performed again using the three modules.

3) Noise analysis was performed by Noisemap software, which is often used by the Air Force for similar analyses.

- The EA provides no assurance as to the reliability or quality of Noisemap results.

- Web searches yield no assessments of the reliability or quality of Noisemap results.

- The EA provides no comparisons between Noisemap results and measurements of actual overflights in the vicinity of DMAFB.

- Davis Monthan AFB was asked on November 3 to provide information on the reliability of Noisemap. The request was to have been forwarded to the Air Force Civil Engineer Center at Joint Base San Antonio-Lackland. To date, neither Davis Monthan nor AFCEC has responded.

- Given the points above, the general public cannot determine whether the results of the noise analysis are trustworthy.

- The EA must provide a comprehensive evaluation of the reliability of Noisemap. The most credible evaluation will compare Noisemap's theoretical decibel levels against actual measurements of aircraft noise at various flight path/flight profile data points.

4) In Subsection 4.1, the EA acknowledges that the Air Force used a draft version of the 2007 Noise Study as the source of its input data for Noisemap. The Air Force assumes "no changes in noise modeling or resulting noise contours have occurred."

- The EA provides no assurance that this assumption is correct.

- If the assumption is not correct, the outputs of Noisemap are not correct. The input data must be revised to reflect actual conditions, and the noise analysis performed again.

5) DMAFB and ACC may decide to change some of the assumptions that underlie the EA's noise analysis. Table 2-1 of Appendix C describes the impacts those changes will have on the analysis. The impacts for Assumptions 3.0 through 7.0 are described as "expected to be negligible on the cumulative [DNL] noise contours."

- Several letters to the 355th FW detail the reasons why the EA must use other metrics, in addition to the DNL metric, to analyze noise. If one or more of Assumptions 3.0 through 7.0 are changed, the results of those metrics will be significantly affected.

To ensure the final decision regarding the TFT EA will withstand legal challenges, these six deficiencies must be corrected, and the public must be given an opportunity to review and comment upon the corrected EA.

Sincerely,

Jan Mosier
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: DNL and Annoyance Response

Dear sirs,

The Air Force and many other agencies use the DNL metric to determine community annoyance as a function of noise. The only tool available to make this correlation between DNL decibels and community annoyance is the Schultz Curve (and its successor curves).

Other letters, which have been submitted during this EA's comment period, cite various shortcomings of the Schultz Curve and of the DNL metric. These shortcomings have been described in academic papers, in publications of the Federal Aviation Administration, and in publications of the Department of Defense.

Sanford Fidell is a noted acoustician, researcher, and author of books on the subject of acoustics. In one of his papers ("The Schultz Curve 25 Years Later: A Research Perspective," *Journal of the Acoustical Society of America*, 2003) he made some pointed observations about DNL, and about its correlation with community annoyance (the Schultz Curve). Below are four of his points from that paper:

> Although U.S. federal adoption of an annoyance-based rationale for regulatory policy has made this approach a familiar one, it is . . . not necessarily the most useful for all purposes.

In other words, Federal agencies commonly use annoyance (the Schultz Curve's correlation of annoyance with DNL) to assess the impacts of noise. However, for many purposes, other methods of assessing the impacts of noise are more useful.

> It is for reasons of expedience rather than any conclusive demonstration of causality that DNL intentionally combines into a single index and thus confounds all of the primary physical characteristics of noise events that could arguably cause noise-induced annoyance.

In other words, DNL is a convenient way to assess noise, but its usefulness has never been demonstrated. DNL is flawed; it combines many different types of noise, each of which has different physical characteristics, into a single number.

> In the United States . . . [the progress] in understanding of community reaction of noise [has ceased] as of a quarter century ago, [which has] led to repeated misprediction of community reaction to noise exposure, and generally reinforced policies that do not accomplish their own goal.

In other words, because so many agencies (including the Air Force) use DNL and the 34-year-old Schultz Curve as their primary noise metric, research has essentially halted on better predictors of noise vs. community reaction. This continuing dependence on a 34-year-old metric reinforces the tendency of government agencies to rely on outdated noise policies.

> Overreliance on officially predicted annoyance prevalence rates to assess community reaction to aircraft noise has also created an institutional disconnect between local and federal perspectives. For all practical federal purposes, "community reaction to noise" means little more than an annoyance prevalence rate estimated by an assumption laden fitting function [the Schultz Curve].

In other words, because Federal agencies assess noise impacts by relying almost entirely on DNL and its Schultz-Curve correlation with annoyance, the Federal assessments do not agree with local perspectives.

The Department of Defense understands just how flawed the Schultz Curve is. In *Using Supplemental Noise Metrics and Analysis Tools* (2009), DoD states

> It should be noted that the dose-response relationship between DNL and annoyance varies over a wide range and is extremely location dependent. **Thus it is inadvisable to use the average annoyance** [Schultz] **curve to predict the specific number or percentage of the local exposed population who are expected to be highly annoyed by aircraft operations at a given DNL.** [Emphasis in original.]

This creates a major problem: The TFT EA is required to use the DNL metric. The DNL metric is useful primarily as a predictor of community annoyance. The tool that correlates DNL with community annoyance is the Schultz Curve. The Department of Defense, in the statement above, advises against using the Schultz Curve. Without the Schultz Curve, the DNL metric is nearly meaningless.

Because the Schultz Curve is flawed, and because the DNL metric (including DNL contours) provide insufficient information to the Air Force decision-makers and to the affected community, the TFT EA must use supplemental metrics to reliably assess the impacts of noise.

Appropriate supplemental metrics are described in other comment letters for this EA.

Without careful and thoughtful use of the supplemental noise metrics, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of aircraft noise must be analyzed with appropriate supplemental metrics.

Sincerely,

Andy Mosier
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: DNL

Dear sirs,

Paragraph 2.3.2 of the EA's Appendix C provides a definition of SEL. The EA's Table 3-1 provides SELs for four of the nineteen types of aircraft that are included in the Preferred Alternative. Neither the EA nor its appendices provide an analysis of the impacts of SELs upon Tucson's residential neighborhoods.

More fundamentally, neither the EA nor its appendices provide an analysis of noise impacts by any metric except DNL.

In 1974, the U.S. Environmental Protection Agency recommended the use of DNL for analysis of noise impacts. Forty years later, Federal agencies still use DNL analysis. Nothing precludes any Federal agency from using additional metrics, though; in fact, in California, airports are *required* by a court decision to use single-event metrics to analyze nighttime noise impacts.

An individual reacts differently to different types of noise. The individual's reaction to the continual white-noise sound of a waterfall is quite different from his reaction to a sudden sharp sound that is many times louder than low background noise. DNL makes no distinction between the two types of noise, however.

Figure 2-5 of the EA's Appendix C demonstrates that extremely loud aircraft noise can yield moderate DNL levels. In Figure 2-5, two of the five events have SELs of 110 and 111 dBA, which is 64 times as loud (yes, sixty-four times as loud) as the 50 dBA background noise of a moderately quiet residential neighborhood. These two events, coupled with three other lesser events, yield a DNL of 64 dBA. A small waterfall could also yield a DNL of 64 dBA.

Is the noise of these extremely loud flyovers equivalent to the sound of a small waterfall? According to DNL metrics, it is.

The current Joint Land Use Study for Tucson and Pima County, prepared with the assistance of the Department of Defense for Davis Monthan AFB, states in Paragraph 5.1.1. "Aircraft noise can be experienced as particularly annoying because its sudden onset may startle people."

The TFT EA claims that this sudden onset and resulting startle effect of aircraft noise should be analyzed no differently than the sound of a small waterfall. Page 4-1 of the EA states, "a single event within a 65 dBA DNL contour can far exceed 65 dB and provide annoyance or a startled reaction; however, the average of the events (i.e., DNL) still represents the most accurate assessment of the conditions."

With that statement, the TFT EA directly contradicts the Department of Defense. Consider this: "To assess the impact of this transitory noise [of an aircraft]," says the Department of Defense, "the Sound Exposure Level, or SEL, is the best measure of the annoyance response" [*Operational Noise Manual: An Orientation for Department of Defense Facilities* (Operational Noise Program, 2005)].

Another Department of Defense publication offers a broader contradiction of the TFT EA statement. Consider this: "While the Federal government has accepted DNL as the best metric for land use compatibility [which is not a major focus of the TFT EA], describing noise exposure solely with DNL may not be adequate to achieve broad public understanding of noise exposure." Further, "supplementing DNL . . . with additional noise exposure metrics improves public understanding of noise exposure and decision makers' ability to make better informed decisions" [*Using Supplemental Noise Metrics and Analysis Tools* (Department of Defense, 2009)].

The TFT EA makes three statements that demonstrate just how ineffective the DNL metric is for analyzing the impacts of its proposal to increase both the number and loudness of TFT operations.

First: "[T]he introduction of additional aircraft types or number of sorties have little effect on the DNL noise contours. Individual aircraft that are different from the routine air traffic would certainly be noticeable due to difference in pitch or volume, but they would have little to no effect on the DNL contours." [Page 3-7]

Second: "[I]ndividual aircraft, such as the F-22 or MV-22, would likely be more noticeable to the general public because they produce noise at a different pitch or volume. However, the inclusion of such aircraft into the air traffic at DMAFB would not necessarily affect the [DNL] noise contours." [Page 4-1]

Third: "The [DNL] noise contours are not a definitive line on the ground such that a slight expansion (e.g.., average less than 100 feet) would likely be imperceptible to the human ear. This shift would result in a fraction of a [DNL] decibel higher than the residents currently experience." [Page 4-2]

With these three statements, the TFT EA illustrates the severe shortcomings of DNL analysis. The Department of Defense has good reason to prescribe additional metrics, which provide much more realistic assessments of aircraft noise.

Several Department of Defense publications provide detailed guides for the use of noise metrics that yield much better analyses of aircraft noise than DNL does. A separate comment letter, whose subject line is "Department of Defense Guides for Noise Analysis," is being submitted to the 355th Fighter Wing; it provides references to some of the relevant DoD publications. The letter also describes several specific noise metrics.

One of the publications [*Improving Aviation Noise Planning, Analysis and Public Communications with Supplemental Metrics* (Department of Defense, 2009)] includes real-life results of the additional metrics. One of several notable results depicts the Naval Air Station at Whidbey Island WA. The SEL 90 dB contour covers far more area than the DNL 65 dB contour does. In fact, the SEL 90 dB contour encompasses urban areas and heavily used state parks.

DNL contours do not reveal critical information such as this.

The Air Force is required to make a good-faith effort in its analysis of noise. A good-faith effort must include the appropriate use of supplemental metrics.

DoD's *Operational Noise Manual* (cited above) warns that even a good-faith effort is not sufficient if it is wrong. The publication cites a Massachusetts case:

> The court ultimately found that the USAF had indeed made a good-faith effort to estimate the noise but [the court's] decision still allowed for citizen recourse if the Environmental Impact Statement estimated noise impacts were exceeded. Thus, litigation continued. . . .

The case ended with substantial settlements to 42 families.

Without careful and thoughtful use of supplemental noise metrics, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified. To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of aircraft noise must be analyzed with the appropriate supplemental metrics.

Sincerely,

Mort Womack
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Physical and Mental Health

Dear sirs,

The EA fails to examine the impacts of aircraft operations on the physical and mental health of Tucson's residents.

It might be argued—successfully or unsuccessfully—that the EA's proposed action will only incrementally affect residents' physical and mental health. The EA fails even to make that argument.

The incremental impact of an action may not in itself be significant. However, the incremental impact, taken together with the incremental impacts of other actions, may create very substantial consequences to the environment. The sum of the incremental impacts may be significant.

This is why the TFT EA is required to analyze the cumulative effects of *all* impacts, even though some incremental impacts may appear to be insignificant.

Cumulative impacts include the effects on residents' physical and mental health. The TFT EA is required to carefully analyze both the incremental and the cumulative impacts of aircraft noise on physical and mental health.

A survey of the literature, which must be a part of the EA's analysis, reveals that aircraft noise can have a significant impact on physical and mental health.

For example, Hegge et al (2002) conducted a longitudinal study of children when the Munich (Germany) airport was moved from one location to another. *Monitor on Psychology* (July/August 2011) describes this study as "one of the most compelling studies in the field of noise pollution."

One of the leaders of the study, Gary W. Evans, PhD, concluded

> This study is among the strongest, probably the most definitive proof that noise—*even at levels that do not produce any hearing damage*—causes stress and is harmful to humans. [Emphasis added.]

Monitor on Psychology summarizes some of the results of the study:

> Munich students near the working airports had significantly higher levels of the stress hormones adrenaline and cortisol and markedly higher blood

> pressure readings than children in quieter neighborhoods. Evidence suggests that elevated blood pressure in childhood predicts higher blood pressure later in life, and higher levels of stress hormones are linked to several life-threatening adult illnesses, including high blood pressure, elevated cholesterol and other lipids, and heart disease.

Monitor on Psychology also cites a report released in 2011 by the World Health Organization and the European Commission's Joint Research Centre. The report analyzed a number of epidemiological studies. *Monitor on Psychology* describes the report's findings:

> A steady exposure to "noise pollution," the report concludes, may lead to higher blood pressure and fatal heart attacks. . . .
>
> The report also confirmed what several psychologists have known for decades: Chronic noise impairs a child's development and may have a lifelong effect on educational attainment and overall health. Numerous studies now show that children exposed to households or classrooms near airplane flight paths, railways or highways are slower in their development of cognitive and language skills and have lower reading scores.
>
> "There is overwhelming evidence that exposure to environmental noise has adverse effects on the health of the population," the report concludes, citing children as particularly vulnerable to the effects of chronic urban and suburban racket.

Monitor on Psychology notes that noise can impact not just physical health, but mental health as well. Quoting psychologist Arline Bronzaft, PhD, an environmental noise researcher and advisor to four New York City mayors on noise policy:

> Noise is a psychological phenomenon. While the ear picks up the sound waves and sends it to the temporal lobe for interpretation, it's the higher senses of the brain that determine whether that sound is unwanted, unpleasant or disturbing, and that's why psychologists need to be heavily involved in this issue.

In a comprehensive publication titled *Community Noise* (edited by Berglund and Lindvall; 1995), the World Health Organization compiled the results of more than nine hundred separate studies of the effects of noise upon humans. *Community Noise* found that health effects include:

- Increase in blood pressure and vasoconstriction, which can lead to eventual hypertension and other cardiovascular disorders.
- Elevated levels of chemicals such as catecholamines, which cause cardiac arrhythmias, platelet aggregation, increased lipid metabolism, and damage to arterial linings.
- Higher risk of angina pectoris.

- Alteration of normal sleep patterns at night, which results in increased fatigue, changes in mood, and decreased performance during the day.
- Irritability, instability, argumentativeness, anxiety, nervousness, insomnia.
- Nausea, headache, loss of appetite, reduction in sexual drive.

Children are even more sensitive to the health effects of noise than adults are, according to the findings of *Community Noise*.

The Department of Defense agrees. DoD's *Operational Noise Manual* (2005) states on page 3-20 that noise can

> lead to physiological changes in children . . . the three principal areas of impact are cardiovascular, cognitive, and personal control. Children chronically exposed to noise may suffer from increased cardiovascular activity and this increased activity may reflect direct sympathetic arousal and/or efforts to cope with the interfering effects of noise.

Monitor on Psychology states

> New noise research in the United States has been scarce . . . since nearly 30 years ago federal funding for noise pollution research was cut after the U.S. Environmental Protection Agency's Office of Noise Abatement and Control was eliminated.

Because of this, researchers do not yet understand the full range of impacts of noise upon health. Absent a complete understanding, the Air Force has an obligation to take a conservative approach when deciding whether to jeopardize the mental and physical health of thousands of Tucson residents.

A conservative approach is especially warranted when the health of children may be impacted even more heavily than adults.

Without a careful evaluation of the relevant literature, and without a quantitative analysis of the impacts (including cumulative impacts) of aircraft noise on the physical and mental health of Tucson's residents, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts on health must be properly analyzed.

Sincerely,

Cheryl Houser
Registered Nurse (Ret.) and resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Impacts Outside DNL 65 dBA Contour

Dear sirs,

The EA provides no substantive analysis of noise impacts outside the DNL 65 dBA contour. This omission must be corrected.

In 2009 the U.S. Transportation Research Board conducted a survey of managers of 35 airports throughout the United States [*Compilation of Noise Programs in Areas Outside DNL 65* (Transportation Research Board 2009)]. The findings include:

> • A majority of respondents (83%) indicated that noise issues outside DNL 65 were "important," "very important," or "critical" to their airport.
>
> • Almost three-quarters of respondents (74%) indicated that more than 75% of their airport's noise complaints come from people who live outside DNL 65.

A Department of Defense publication discusses DNL 65 dBA contour lines. It concludes, "Clearly, it is not the intent of Federal policy to communicate that noise stops at that [DNL 65 dBA contour] boundary" [*Improving Aviation Noise Planning, Analysis and Public Communications with Supplemental Metrics* (Department of Defense, 2009)].

In response to requirements of the Noise Control Act of 1972, the EPA issued an influential publication that is commonly referred to as "The Levels Document." This document states that noise should not exceed DNL 55 dBA in order "to protect public health and welfare," in the words of the Noise Control Act.

Another EPA publication [*Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (Environmental Protection Agency, 1974)] states:

> Outdoor yearly levels on the Ldn [DNL] scale are sufficient to protect public health and welfare if they do not exceed 55 dB in sensitive areas (residences, schools, and hospitals). . . . Maintaining 55 Ldn [DNL] outdoors should ensure adequate protection for indoor living.

Many Federal and state agencies consider any property subject to DNL 65 decibels or more to be "not compatible with residential use." The Arizona Revised Statutes impose severe restrictions on the use of properties that are subject to DNL 65 dB or greater. By electing not to carefully consider all impacts outside the DNL 65 dB contour, the EA wrongfully concludes that, if a property is not subject to legal restrictions because of severe noise, then its impacts are so negligible as to be unworthy of consideration.

The EA must analyze all noise impacts throughout the entire Region of Influence. Supplemental noise metrics, as described in other comment letters, will yield the best analyses of impacts outside the DNL 65 dB contour. Further, as described in other comment letters, the analyses must evaluate cumulative impacts. The analyses must also be quantitative; a narrative listing of impacts is not sufficient.

Without a careful quantitative analysis of the impacts of aircraft noise beyond the DNL 65 dB contour, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts must be properly analyzed.

Sincerely,

Lorna Soroko
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Intermittent Operations

Dear sirs:

The TFT EA provides noise analyses only of approach and departure flight paths. The EA does not provide analyses of TFT operations that are intermittently conducted directly above the City of Tucson.

A recent example of an intermittent TFT operation occurred on Tuesday, November 4, during training of the Navy's HSC-4 unit. (As part of the TFT mission, HSC-4 helicopters, as well as helicopters from the Navy's HSC-85 reserve unit, conducted additional operations over Tucson in the days following.)

During the course of about seven hours on November 4, six MH-60S helicopters flew over Tucson's residential, commercial, and business areas. Their routes included flights to and from the University Medical Center and Tucson Medical Center. At University Medical Center, the helicopters made a total of twelve landings and twelve takeoffs at the hospital's helipad. At Tucson Medical Center, the helicopters practiced approaches to and departures from the facility but did not land.

The MH-60S helicopters flew low over urban Tucson; their exercises necessitated that. Though TFT presumably had permission from administrators of both hospitals, the helicopters' loud noise surely was disruptive to patients and hospital staff. Helicopter noise also disturbed the residential neighborhoods, restaurants, and businesses adjacent to the two hospitals. A public grade school is immediately north of Tucson Medical Center; a Catholic grade school is just across the street from University Medical Center. In addition, University Medical Center is abutted by buildings and classrooms of the University of Arizona.

Noise generated by helicopters is quite different from the noise of fixed-wing aircraft; in fact, the Department of Defense's *Operational Noise Manual* devotes an entire section to describing the noise that is unique to helicopters. The noise is so difficult to quantify that the Air Force's Noisemap was unable to properly analyze it, until NASA stepped in and developed the Rotorcraft Noise Model.

Because of its unique nature, helicopter noise is very disturbing to quiet neighborhoods. The TFT EA is negligent in its failure to analyze the impacts of intermittent helicopter operations such as that described above. The EA is also negligent in its failure to analyze the impacts of fixed-wing aircraft whose TFT operations sometimes take them over Tucson on routes that have not been assessed by the EA.

Because these helicopter and fixed-wing operations are very intermittent, they will not affect DNL contours. Their impacts can be determined only by the use of supplemental noise metrics.

The significance of the impacts of TFT's intermittent operations over Tucson cannot be known until they are properly assessed. Without the analysis of these intermittent operations with supplemental noise metrics, and without knowledge of the significance of their impacts, the Air Force cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of the intermittent operations must be analyzed with the appropriate supplemental noise metrics.

Sincerely,

Linda Marble
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Loud Aircraft

Dear sirs,

On February 3, 2010, four F-18s landed at Davis-Monthan AFB, adjacent to Tucson. The F-18s' noise was so loud that it made the local newscasts that evening, and was featured on a front-page story in the next morning's Arizona Daily *Star*.

With the headline "Military Jets' Noise Hits Nerve," the front-page article said the F-18s "descended upon the city at midday Tuesday, halting conversations, setting off car alarms and sparking complaint calls to the Arizona Daily Star." (DMAFB had shut down its own complaint line just before the F-18s arrived.)

The article quoted a midtown resident as saying, "Normally, I'm not too bothered by aircraft noise, but this shook the windows. If you were talking to someone right next to you, you'd have to shout to communicate." Another resident was quoted as saying, "It was insanely loud, almost unbearable. You had to cover your ears. . . . I like to be a gracious host to the military, but this was not acceptable."

The EA's Alternatives 1 and 2 will bring F-18s and other equally loud aircraft, such as the F-15, F-16, and F-22, to Tucson.

The *Star's* description makes it clear that the impacts of these loud aircraft will be severe. However, the EA disguises those impacts by hiding them in DNL analysis.

Page 3-7 of the EA says, "the introduction of additional aircraft types or number of sorties have little effect on the DNL noise contours. Individual aircraft that are different from the routine air traffic would certainly be noticeable due to difference in pitch or volume, but they would have little to no effect on the DNL contours."

Page 4-1 of the EA says, "individual aircraft, such as the F-22 or MV-22, would likely be more noticeable to the general public because they produce noise at a different pitch or volume. However, the inclusion of such aircraft into the air traffic at DMAFB would not necessarily affect the [DNL] noise contours."

Page 4-2 of the EA says, "The [DNL] noise contours are not a definitive line on the ground such that a slight expansion (e.g.., average less than 100 feet) would likely be imperceptible to the human ear. This shift would result in a fraction of a [DNL] decibel higher than the residents currently experience."

Because DNL analysis disguises the true impacts of these loud aircraft, additional analyses of their noise must be performed under Department of Defense guides, as described in DoD publications such as *Improving Aviation Noise Planning, Analysis and Public Communications with Supplemental Metrics* (Department of Defense, 2009) and *Using Supplemental Noise Metrics and Analysis Tools* (Department of Defense, 2009).

These publications describe supplemental noise metrics that are much more effective than DNL in determining the impacts of aircraft noise. Without careful and thoughtful use of the supplemental noise metrics, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of aircraft noise must be analyzed with the appropriate supplemental metrics.

Sincerely,

Barbara Hall
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Department of Defense Guides for Noise Analysis

Dear sirs,

The TFT EA uses only one method to analyze the impacts of noise: DNL. The EA justifies this on its page 3-4: "DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974)."

This USEPA recommendation is forty years old.

Though DNL analysis is still commonly used, acoustics experts have recognized during the past four decades that DNL analysis tells only part of the story. For environments affected by short-duration, high-SEL events such as aircraft noise, DNL analysis fails to describe the most serious impacts.

The Air Force and other Federal agencies use the DNL metric primarily because it is the only metric for which a dose/response (decibels vs. annoyance) relationship has been established. According to the Department of Defense, "DNWG [DoD's Noise Working Group] is not aware of any research to suggest that there is a better metric than DNL to relate to annoyance" [*Community Annoyance Caused by Noise From Military Aircraft Operations* (Department of Defense, 2009); hereinafter referred to as *DoD Community Annoyance*].

DoD Community Annoyance recognizes the shortcomings of correlating DNL with annoyance. It cites "methodological questions, errors in measurement of both noise exposure and reported annoyance, data interpretation differences, and the problem of community response bias . . .[and] an extraordinary amount of scatter in the data."

DoD Community Annoyance notes that, despite all of these problems, "Means for predicting the immediate annoyance of individual overflights . . . remain less well developed [than DNL metrics]." DNL is used to predict community annoyance primarily because "the relationship between single event noise levels and annoyance" has not been established. This is "[a]n area of research that remains to be investigated."

In environmental analyses, the quantification of annoyance is only one aspect of measuring the impacts of noise. The Department of Defense recognizes this. The TFT EA does not.

According to the Department of Defense,

> The Military Services of the U.S. Department of Defense (DoD) have long relied on traditional methods of analyzing aircraft noise using the Day Night Average Sound Level (DNL) metric. . . . Recently, however, a need has been identified to use other supplemental analysis tools and noise metrics for two reasons: (1) to produce more detailed noise exposure information for the decision process; and (2) to improve communication with the public about noise exposure from military activities. Better communication with all stakeholders and the general public is clearly a benefit to both the Military and the adjacent communities. [*Improving Aviation Noise Planning, Analysis and Public Communications with Supplemental Metrics* (Department of Defense, 2009); hereinafter referred to as *DoD Supplemental Metrics*]

Because the TFT EA uses only DNL to analyze the impacts of noise, it fails to fulfill DoD's two objectives directly above—producing more detailed noise exposure information for the decision process, and improving communication with the public about noise exposure from military activities.

DoD Supplemental Metrics establishes guides to provide "more useful information on the noise environment than is available through solely using the long-term, cumulative metrics such as DNL." Other DoD publications also provide guides for noise metrics that are more useful than DNL.

DoD Supplemental Metrics explains why analyses such as the TFT EA are mistaken to rely solely on DNL metrics:

> When using DNL to communicate noise exposure to the average citizen residing near a military airfield, a typical response is, "I don't hear averages, I hear individual airplanes." Airport neighbors often become angry and frustrated trying to understand explanations of noise exposure solely in terms of average sound energy with the DNL metric, particularly when they are trying to grasp the impact of . . . increased operations and aircraft changes.

Relying solely on DNL metrics can create problems at later dates. Here are two examples:

> Dallas-Fort Worth International Airport was sited on about 18,000 acres of land in the early 1970s, even though its projected Ldn [DNL] 65 dB cumulative noise exposure encompassed far less area. Likewise, Denver International Airport was sited on about 29,000 acres, even though its projected Ldn [DNL] 65 dB cumulative noise exposure contour was considerably smaller. Both of these greenfield airports have nonetheless attracted tens of thousands of aircraft noise complaints over the years, some from communities many miles from their Ldn [DNL] cumulative noise exposure contours. [*The Schultz Curve 25 Years Later: A Research Perspective* (Fidell, 2003)]

To avoid similar problems at DMAFB, the Air Force must heed *DoD Supplemental Metrics*:

> While the Federal agencies have accepted DNL as the best metric for land use compatibility guides [which is not a major focus of the TFT EA], reducing the description of noise exposure to a single value of DNL may not help the public understand noise exposure. Simply looking at the location of their home on a DNL contour map does not answer the important questions: how many times airplanes fly over, what time of day, what type of airplanes, or how these flights may interfere with activities, such as sleep and watching television. The number and intensity of the individual noise events that make up DNL are critically important to public understanding of the effects of noise around airports. What is needed is a better way to communicate noise exposure in terms that are more easily understood. Supplementing DNL with additional metrics will help the public better understand noise exposure.

DoD Supplemental Metrics quotes a publication of the Australian Government:

> In simple terms people want to be told about aircraft noise exposure in their own language – where flight paths are, how many movements, what time of day, etc. – but the official response has been to provide information in the form of a single figure Australian Noise Exposure Forecast (ANEF) value, similar in concept to the DNL metric. Not unnaturally there has frequently been a breakdown in communication between the "noise expert" and the community, which we consider has been at the expense of both parties.
>
> . . . Providing "real" aircraft noise information for all of the areas likely to be subject to changes in aircraft noise enables the community to actively and meaningfully participate in any public consultation process. It also gives the decision makers a much clearer picture of what the outcomes will be if they approve the project. [*Expanding Ways to Describe and Assess Aircraft Noise* (Australian Department of Transportation and Regional Services, 2000)]

DoD Supplemental Metrics provides detailed guides for the analysis and presentation of

- Maximum A-Weighted Sound Levels (Lmax)
- Sound Exposure Level (SEL)
- Equivalent Sound Level
- Time Above a Specified Sound Level (TA)
- Number-of-Events Above a Specified Sound Level (NA)
- Respite

At least some of these metrics can be calculated and analyzed with NOISEMAP. Because the TFT EA uses NOISEMAP for its DNL metric, the inputs for these additional metrics may already be complete.

DoD Supplemental Metrics recommends that results of the above metrics be presented in tables and/or as contour lines on maps (just as the TFT EA presents DNL contour lines). The publication includes several real-life examples of both.

The contour maps are particularly striking. At a glance, they provide very important information that is totally absent from DNL metrics. One example is attached; it depicts Marine Corps Air Station Cherry Point, in North Carolina. The 65 dB DNL contour line is red; the single-event contour line for 90 dB SEL is blue. Note that, at its northernmost point, the 90 dB SEL contour extends nearly nine miles beyond the DNL 65 dB contour.

This is crucial information. As *DoD Supplemental Metrics* explains, the above metrics "are as important to the project stakeholders as they are to communicating with the general public, because they enable the project managers and decision makers to make better-informed decisions."

Failure to include these metrics can lead to litigation. *DoD Supplemental Metrics* describes one successful lawsuit:

> The City of Oakland CA prepared the required Environmental Impact Report (EIR) to analyze the consequences of their proposed Airport Development Plan for the Metropolitan Oakland International Airport. Its adequacy in defining nighttime noise impacts solely with the DNL noise metric was challenged in court by a citizens group and in its decision, the California appeals court set a precedent (at least in California) that DNL 65 dB is not a sufficient criteria to use in Environmental Impact Reports for this purpose and that single event noise levels must also be considered.

Without careful and thoughtful use of the supplemental noise metrics, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of aircraft noise must be analyzed with the appropriate supplemental metrics.

Sincerely,

Karen Fisher
Resident of Tucson

Attachment

Attachment to TFT EA Comment Submittal
Re: Department of Defense Guides for Noise Analysis

QuickTime™ and a
decompressor
are needed to see this picture.

Marine Corps Air Station Cherry Point, NC (contours highlighted)
Figure B-6, page B-16, *Improving Aviation Noise Planning, Analysis and Public Communications with Supplemental Metrics* (Department of Defense, 2009)

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Property Values and Aircraft Noise

Dear sirs,

The EA's analysis of property values demonstrates only one thing: During the thirteen years reviewed, property values of two census tracts generally increased more than Pima County's overall property values did; and the two tracts' values generally decreased more than Pima County's did.

To describe this succinctly: The two tracts' property values are more volatile than Pima County's property values are.

For real estate, as for any other investment, volatility is undesirable.

Is this volatility due to aircraft noise? More generally, are the property-value increases and decreases of the two tracts due to aircraft noise?

The EA's analysis provides no clue to the answers of these two questions.

For each of the thirteen years reviewed, the EA provides the year-over-year change in property values for the two tracts. It does not provide a corresponding year-over-year change in the levels of aircraft noise.

Without this correlation, the analysis cannot—and does not—determine whether property values and aircraft noise are related.

The EA's analysis of property values fails utterly to address the one basic question: Does aircraft noise affect property values?

Without a careful and truthful analysis of the impacts of aircraft noise on property values, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, property values must be properly analyzed.

Sincerely,

Jane Powers
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Property Values and Comps

Dear sirs,

A fundamental principle of property-value analysis is the comparison of "comps," or comparable properties.

The TFT EA compares property values of Census Groups A and B against those of Pima County as a whole. This is a mistake; Groups A and B are not comparable to the entirety of Pima County.

The two Census Groups encompass primarily residential properties, with industrial properties along the Union Pacific yard and to its southeast. In contrast, Pima County encompasses primarily agricultural properties and properties of undeveloped land; residential and industrial properties are generally limited to Tucson and small towns. About half of Pima County is comprised of an Indian reservation.

Market forces that drive the values of undeveloped and agricultural properties are quite different from the market forces that drive the values of the two Census Groups. (Even within Tucson, market forces for residential and industrial properties vary significantly from one location to another.) The EA fails to take this into consideration.

For anybody familiar with property valuations, the EA's "analysis" is meaningless.

The EA must abandon its indefensible "analysis," and instead employ a methodology that conforms to the universally accepted standards of property-value appraisals. This will entail the use of legitimate "comps."

Without a careful and truthful analysis of the impacts of aircraft noise on property values, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, property values must be properly analyzed.

Sincerely,

Don Powers
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Property Values

Dear sirs,

Executive Order No. 13352, which was signed by President George W. Bush and which is appended to the National Environmental Policy Act, states that the Secretary of Defense shall "carry out the programs, projects, and activities of the [Department of Defense] . . . in a manner that . . . takes appropriate account of and respects the interests of persons with ownership or other legally recognized interests in land and other natural resources."

To comply with this Executive Order, the EA must "take appropriate account" of the impacts of aircraft noise upon affected properties. The impacts include effects on property values.

As detailed in other comment letters submitted to the 355th Fighter Wing, the EA's analysis of property values is fundamentally flawed.

To correct the flaws, the EA must use accepted methods of property valuation. Further, it must incorporate the results of the many studies that directly correlate property values with aircraft noise.

The Federal Aviation Administration (FAA) states quite bluntly, "Studies have shown that aircraft noise does decrease the value of residential property located around airports" [*Aviation Noise Effects* (FAA, 1985)].

FAA has carefully compiled its *Aviation Noise Effects*, which "has been developed after reviewing the rather extensive literature in each topical area, including many original research papers, and also by taking advantage of literature searches and reviews carried out under FAA and other Federal funding over the past two decades."

Aviation Noise Effects summarizes nine studies of residential property values in the vicinities of major airports in the United States and Canada. Without exception, the studies demonstrate that aircraft noise decreases property values.

Across the nine studies, property values decrease between 0.6% per DNL decibel and 2.3% per DNL decibel.

In its *F-35A Training Basing EIS* (2012), the Air Force analyzed the effects of F-35A noise on property values. That analysis is specific to Tucson. It concludes that “The noise generated by the F-35A could have an adverse impact on property values.” The document also notes, “the value of a specific property could be discounted between 0.5 and 0.6 percent per decibel when compared to a similar property that is not affected by aircraft noise.”

While this is less than most other published figures, the Air Force does recognize that F-35A noise could decrease Tucson’s property values. In contrast, the Air Force denies that the noise of TFT aircraft could decrease property values.

A very comprehensive review of property-value studies is *Meta-Analysis of Airport Noise and Hedonic Property Values* (Nelson, 2004), hereinafter referred to as *Meta-Analysis*.

In *Meta-Analysis*, author Nelson used a statistical procedure, known as meta-analysis, to assess twenty studies that encompassed 33 reviews of residential property values at 23 airports in the United States and Canada.

The term “meta-analysis” refers to widely accepted statistical methods that combine and contrast the results of different studies. This is necessary because different studies may use different parameters. Meta-analysis statistically equalizes the studies, so their results are comparable.

Each of the twenty studies included in *Meta-Analysis* were based upon hedonic property values.

The term “hedonic property values” is best explained by author Nelson:

> Consider two residential properties that are identical in all respects, except that one house is located close to or under an aircraft flight path, and the other is not. A **but for analysis** establishes that the adverse environment for the first house will result in a market value that is lower than the market value of the second house. . . .
>
> It is rare that two residential properties will be identical in all respects, except for the pollutant in question. Consequently, in order to isolate a given hedonic price, it is necessary to control statistically for other influences on property values, such as the size of house and lot, quality of construction, design of the house, merits of the neighborhood, quality of local schools, crime rates, governmental services, and so forth.

Table 1 of *Meta-Analysis* summarizes the results of the twenty studies.

Every one of the studies confirms that aircraft noise decreases property values. Decreases range from a low of 0.29% per DNL decibel to a high of 1.49% per DNL decibel. For all studies, the mean (average) decrease is 0.75% per DNL decibel.

The methodology and findings of *Meta-Analysis* and of the FAA's *Aviation Noise Effects* are undeniable. They contrast sharply with the sophism of the property-value "analysis" used by the TFT EA.

The EA must acknowledge the findings of meticulous and comprehensive studies such as those cited above. The EA must also abandon its indefensible "analysis," and instead employ a methodology that conforms to the standards of both Realtors and statisticians.

The EA, of course, is required to analyze the cumulative impacts of *all* aircraft noise upon property values throughout the EA's Region of Influence.

Without a careful quantitative analysis of the impacts (including cumulative impacts) of aircraft noise on the ROI's property values, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, property values must be properly analyzed.

Sincerely,

Ralph Marble
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Schultz Curve

Dear sirs,

In past decades, the Schultz Curve has often been used to demonstrate the relationship between DNL levels and community annoyance. The TFT EA includes the Schultz Curve as Figure 3-1 on page 3-4 of the EA, and as Figure 2-6 on page 11 of Appendix C.

Appendix C concludes the Schultz Curve "shows that approximately 13% of communities are highly annoyed at a DNL 65 dBA" (page 11).

The Schultz Curve shown in the EA and Appendix C was published in 1978. The Air Force ignores the follow-up data and critical analyses of the Schultz Curve that have been published during the intervening 36 years.

Acoustics experts agree that the 1978 Schultz Curve fails to distinguish among varying annoyance responses due to different noise sources. [See, for example, *Community Annoyance from Aircraft and Ground Vehicle Noise* (Journal of the Acoustical Society of America, October 1982).] For a highway, a DNL of 65 dBA may represent a fairly constant level of noise, which provokes one annoyance response. For an airport, a DNL of 65 dBA may represent a series of short-duration, high SEL noises superimposed over low-level background sound; this provokes an entirely different annoyance response.

The 1978 Schultz Curve, and the TFT EA, do not consider this crucial difference.

Another curve, the FICON Curve, is an update of the original Schultz Curve. The two are quite similar in their assumptions and their dose/response relationships. Some Federal agencies, including the Air Force, have adopted the FICON Curve over the Schultz Curve (though the TFT EA uses the older Schultz Curve). According to acoustics experts, both curves suffer from similar shortcomings. *The Schultz Curve 25 Years Later: A Research Perspective* (Fidell, 2003) observes of the FICON Curve, "The accuracy and precision of estimates of the prevalence of a consequential degree of noise-induced annoyance yielded by functions of noise exposure leave much to be desired." More bluntly, the 2005 joint meeting of the Acoustical Society of America (ASA) and Noise-Con concluded, "the assumption [of the FICON Curve] that there are no significant differences between the attitudinal survey results for airports vis-à-vis road traffic or railroads is unsustainable based on the data. *It is recommended that the FICON curve not be used to assess airport noise.*" [Emphasis added.])

At the 2005 ASA/Noise-Con meeting, the Fidell Curve was introduced. Like the Schultz and FICON Curves, the Fidell Curve depicts a dose/response relationship. However, it is unique in that it differentiates among annoyance responses from different noise sources. Further, it is based on 453 data points comprising 29 data sets, which is nearly triple the data upon which the Schultz Curve is based. The Fidell Curve is attached.

In the Fidell Curve, airport data-points are shown as red diamonds, highway data-points as blue squares, and railroad data-points as green triangles. The red line is an average of the airport data-points.

(Note that the attached Fidell Curve also portrays the FICON Curve.)

The Fidell Curve shows that, at a DNL of 65 dBA, about 28% of communities are highly annoyed. *This is more than twice as high as the 13% that the TFT EA claims, using the 1978 Schultz Curve.*

The TFT EA is dishonest to use an outdated 34-year-old version of the Schultz Curve.

The accuracy of the Fidell Curve is corroborated by others. *Aviation Noise Effects* (Federal Aviation Administration, 1985) includes several DNL vs. Annoyance curves from various independent sources. Most of these curves are similar to the red airport curve of the Fidell Curve. A few curves show even higher annoyance; for example, "Comparison of Various Measures of Individual Annoyance and Community Reaction" (Figure 3.4, page 25) shows 35% of communities to be "Highly Annoyed" at DNL 65 dBA.

Some curves in the FAA publication provide additional information that is quite revealing. For example, "Annoyance Caused by Aircraft Noise in Residential Communities Near Major Airports" (Figure 3.1, page 22) shows that, at DNL 65 dBA, a staggering 67% of communities are "Annoyed" or "Highly Annoyed."

The FAA publication includes another curve, "Community Response to Aircraft Noise—Netherlands Survey" (Figure 3.2, page 22) which shows that, **at DNL 65 dBA, about 65% of communities "Feel Afraid."**

Effects of Aircraft Noise: Research Update on Selected Topics (Transportation Research Board, 2009) states, "Miedema and Vos (1998, 1999) have compiled the most comprehensive database of community annoyance data yet available, and several studies have been published on the results of their meta-analyses." One such study was made by Wyle Laboratories, which noted, "Miedema & Vos present synthesis curves . . . for three transportation sources. Separate non-identical curves were found for aircraft, road traffic, and railway noise." The Wyle study summarized the data in this table:

QuickTime™ and a
decompressor
are needed to see this picture.

The table shows that, for noise generated by aircraft, 28% of communities are highly annoyed at DNL 65 dBA. This corresponds precisely to the Fidell Curve.

The Air Force has no basis for using the outdated Schultz Curve from 34 years ago. Further, the Air Force has no basis for ignoring three decades of more recent data and analyses, including the Fidell Curve.

Unless it uses the most recent and most accurate dose/response data, including the Fidell Curve and additional curves such as those in FAA's *Aviation Noise Effects*, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts of aircraft noise must be analyzed with up-to-date dose/response curves.

Sincerely,

Gary A. Hunter
Resident of Tucson

Attachment

Attachment to TFT EA Comment Submittal
Re: Schultz Curve

QuickTime™ and a
decompressor
are needed to see this picture.

Fidell Curve, from joint meeting of the Acoustical Society of America and Noise-Con (Minneapolis MN, October 2005)

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Impacts on Students

Dear sirs,

The EA fails to examine the impacts of TFT operations on students.

The Air Force has an obligation under the National Environmental Policy Act to consider all potential impacts of its proposed action. Impacts on students are a major concern, but the EA ignores those impacts.

It might be argued—successfully or unsuccessfully—that the EA's proposed action will only incrementally affect students. The EA fails even to make that argument.

The incremental impact of an action may not in itself be significant. However, the incremental impact, taken together with the incremental impacts of other actions, may create very substantial consequences to the environment. The sum of the incremental impacts may be significant.

This is why the TFT EA is required to analyze the cumulative effects of *all* impacts, even though some incremental impacts may appear to be insignificant.

Cumulative impacts include the effects on students. The TFT EA is required to carefully analyze both the incremental and the cumulative impacts of aircraft noise on students.

A survey of the literature, which must be a part of the EA's analysis, reveals that aircraft noise can have a significant impact on students.

For example, Hegge et al (2002) conducted a longitudinal study of children when the Munich (Germany) airport was moved from one location to another. The July/August, 2011, issue of *Monitor on Psychology* describes this study as "one of the most compelling studies in the field of noise pollution."

Monitor on Psychology summarizes the study:

> Six months before and 12 and 18 months after the [Munich] airport closed and moved to a distant location, researchers . . . administered tests of reading, memory, attention and hearing to third- and fourth-graders who lived and attended school near the two airport sites. They found that the reading

> comprehension skills and long-term memory of children near the old airport improved once air traffic moved to the new airport, while the performance of children near the new airport declined.

This study demonstrates an unequivocal link between aircraft noise and students' performance.

In the vicinity of the old airport, some skills remained depressed after the airport closed. For example, students' speech perception—their abilities to understand their teachers, classmates, parents, and others—did not improve. *Monitor on Psychology* describes this:

> After the old airport closed . . . [the students'] speech perception remained impaired, says Evans, [one of the authors of the study and] a professor of human ecology at Cornell University.
>
> "We think one thing that might be going on is that children who are exposed to noise develop a stress response of ignoring the noise, but not only do they ignore the noise, there's evidence they also ignore speech," Evans says. "So not only are they ignoring the stimuli that are harmful, but they're also ignoring stimuli that they need to pay attention to."

The students' poor academic performance will handicap them for the rest of their lives. For the students who will be impacted by the noise—and for a community that depends upon an educated workforce—the long-term effects will be unfortunate.

Does the Air Force not care about this?

The Department of Defense does care. DoD's *Operational Noise Manual* (2005) states:

> There is some evidence that high levels of noise in classrooms can even lead to physiological changes in children. According to Evans (1993), the three principal areas of impact are cardiovascular, cognitive, and personal control. . . . In the short term, the children can cope, but in the long term, they have lower motivation, lower reading scores, and less patience for solving difficult problems.

DOD's *Operational Noise Manual* lists those students who are most susceptible to the impacts of noise:

- The youngest
- Those with English as a second language
- Any child suffering from a hearing deficiency (including short term hearing loss from middle ear infections)
- Children starting with below average academic skills
- Children with Attention Deficit Disorder (ADD)

The EA's Table 3-11 shows that, of the Tucson residents who are most impacted by the noise of Davis Monthan aircraft, the majority are minorities. In Tucson, most minorities are Hispanic. For many of those, English is a second language. As noted directly above, *Operational Noise Manual* states that students with English as a second language are among those who are most susceptible to the impacts of noise.

In a comprehensive publication titled *Community Noise* (edited by Berglund and Lindvall, 1995), the World Health Organization compiled the results of more than nine hundred separate studies on the effects of noise upon humans. *Community Noise* determined that students affected by aircraft noise have greater difficulty learning to read. The affected students also have greater difficulty processing information.

The American National Standards Institute (ANSI) has established commonly recognized standards for classroom noise. When the noisiest hour in a classroom is dominated by sources such as aircraft, the limits for most classrooms are an hourly average sound level of 40 dBA, and the sound level must not exceed 40 dBA for more than 10 percent of the hour. [*Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools* (ANSI, 2002 & 2009)].

In *Using Supplemental Noise Metrics and Analysis Tools* (DoD, 2009) (hereinafter referred to as *Supplemental Metrics*), the Department of Defense prescribes the Leq (equivalent sound level) metric to identify schools that are potentially impacted by high-decibel aircraft noise. (Merely stating whether a school is within the DNL 65 dB contour, as the TFT EA does, is not sufficient.) *Supplemental Metrics* prescribes that all schools subjected to an eight-hour Leq of least 60 dBA outdoors be analyzed further.

For schools that warrant further analysis, *Supplemental Metrics* prescribes the metric of NA75 (Lmax) for outdoors noise. For an eight-hour school day, this yields the number of events in which outdoor noise exceeds 75 dBA (approximately equal to 50 dBA inside classrooms).

Supplemental Metrics also prescribes the metric of TA75 (Lmax) for outdoor noise. This yields the number of minutes in eight hours in which outdoor noise exceeds 75 dBA (approximately equal to 50 dBA inside classrooms).

To compare classroom decibel levels directly against the ANSI standards above, the use of TA65 (Lmax) is necessary.

Because the TFT EA is required to analyze cumulative effects, the combined noise impacts of all aircraft must be assessed with the noise metrics prescribed by *Supplemental Metrics*.

These metrics yield quantitative results, which are meaningful and revealing to the Air Force's decision-makers, and to residents of the affected community. In contrast, the

EA's "analysis" consists only of an uninformative statement that no schools and one day-care center are located within the DNL 65 dB contour.

Without a careful evaluation of the relevant literature, and without a quantitative analysis of the impacts (including cumulative impacts) of aircraft noise on students, the Air Force cannot know whether the impacts are significant, and cannot conclude that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the impacts on health must be properly analyzed.

Sincerely,

Linda Phelan
Retired teacher and resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Substantive Comments

Dear sirs,

During the comment period for the 2013 draft of the OSB EA, some letters were submitted that provided only general remarks ("I support all missions at the base;" "I don't like loud aircraft"). Other letters were thoughtful, analytical, and carefully researched.

Appendix A of the TFT EA contains 416 pages of Tucsonans' comments. The Air Force has trivialized those comments, many of which are quite substantive, by reducing all of them into one column of one table (Table 1-2).

For each category in the column, the letters' contents are summarized with a single sentence. That single sentence is an utterly inadequate—and often, wildly inaccurate—summary of the letters' substance. Meticulously documented facts are ignored; solid analysis is disregarded.

For each category, the Air Force provides a response of only one or two sentences. The responses are dismissive, and trivialize some important concerns of Tucsonans.

During the current comment period, the Air Force is receiving substantive new comments. These comments cannot be dismissed with a single sentence that is intended to respond to multiple letters. 40 CFR 1503.4(a) requires the Air Force to "assess and consider comments both *individually* and collectively [emphasis added].

For every substantive point in a letter, the Air Force must provide a substantive response.

If a letter-writer's point is reasonable—and especially if the point is backed by Federal regulations or court decisions—the Air Force must act positively, and must implement the writer's counsel.

If the Air Force disagrees with a comment, or with a quotation taken from a Department of Defense publication or other source, it must "[e]xplain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position" [40 CFR 1503.4(a)(5)].

Without careful and thoughtful consideration of each substantive comment, the Air Force cannot conclude that TFT impacts are not significant, and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the Air Force must provide a well-considered and balanced evaluation of each letter.

Sincerely,

Rosamond Finley
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Verification of Noisemap

Dear sirs:

The EA's analysis of noise relies exclusively on Noisemap. If Noisemap is not reliable, then the EA's noise analysis is not reliable, and the EA cannot conclude that noise impacts are not significant.

On November 3, the undersigned asked Davis Monthan's Captain Casey Osborne and Civil Engineer Joe Doyle for verification of Noisemap's reliability. After working with the Air Force Civil Engineer Center on this request, Captain Osborne and Mr. Casey were able to provide links to two documents. The undersigned received the links on today's date, the deadline for submitting comment letters.

The first link is to a document that was released 24 years ago. It describes Noisemap 6.0. The Air Force has made substantial changes to Noisemap since then. In fact, Noisemap 6.0 would not have included the parameters for aircraft that will be used in any of the three TFT EA alternatives.

To substantiate its statement that Noisemap results have been validated, the document cites its Reference 4. Reference 4 was published 32 years ago, when an even earlier version of Noisemap was in use.

The second link provided by Captain Osborne and Mr. Doyle appears to be that Reference 4, from 32 years ago. The reference describes tests made at Laughlin AFB and at Homestead AFB. The document notes the testing contractors had difficulty correlating their Laughlin test results with Noisemap outputs. This is irrelevant, though, because 32-year-old test results tell us nothing about the reliability of the current version of Noisemap.

Unless the TFT EA demonstrates that outputs of the current Noisemap are reliable, it cannot conclude that noise impacts are not significant and that a FONSI is justified.

To ensure the final decision regarding the TFT EA will withstand legal challenges, the EA must provide substantive verification—which will include actual test results—that the current version of Noisemap is reliable.

Sincerely,

Gary A. Hunter
Resident of Tucson

November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Re: Verification of Noisemap, Part 2

Dear sirs:

Earlier today a comment letter was submitted re Verification of Noisemap. This letter amplifies that letter, and incorporates it by reference.

The Verification of Noisemap letter stated that late this morning USAF Captain Osborne and Civil Engineer Joe Doyle, working with the Air Force Civil Engineer Center, had provided the undersigned with two documents relating to verification of Noisemap. The first is *Noisemap 6.0 – The USAF Microcomputer Program for Airport Noise Analysis* (Biodynamic Environment Branch, Harry G. Armstrong Aerospace Medical Research Laboratory, 1990), hereinafter referred to as *Noisemap 6.0*. The second is *Field Studies of the Air Force Procedures (Noisecheck) for Measuring Community Noise Exposure from Aircraft Operations* (R.A. Lee, 1982), hereinafter referred to as *Field Studies*.

After the undersigned noted in an email to Captain Osborne that the two documents are dated 1990 and 1982 respectively, and after the Verification of Noisemap letter had been written, USAF Captain Osborne stated in an email to the undersigned that more recent verifications of Noisemap are apparently unknown. “I’m afraid we don’t have any more current answers for you,” Captain Osborne wrote.

Noisemap 6.0 and *Field Studies* describe only a single Noisemap verification study, performed at Laughlin AFB and Homestead AFB. The study was made in 1979, three years before *Field Studies* was released, eleven years before *Noisemap 6.0* was released, and thirty-five years before the draft TFT EA was released.

Technology has changed since 1979. For example, the two reports were composed on typewriters, which are far removed from today’s digital word processing. Similarly, the measuring equipment used in the 1979 test—and the fascinating description of their calibration process in *Field Studies*—belong in a museum. Just as digital word processing has succeeded typewriters, digital sound monitoring equipment has far surpassed the abilities and accuracy of 1979’s vacuum-tube equipment.

Similarly, aircraft technology has changed. At Laughlin, the 1979 test measured the noise of T-37s and T-38s, which were introduced by Cessna in 1958 and 1959. At Homestead, the test measured the noise of F-4s, which were introduced by McDonnel in 1960. The noise profiles of these aircraft are quite different from the noise profiles of the aircraft—both fixed-wing and rotor—that TFT currently uses and proposes to use.

Field Studies documents substantial problems with testing procedures at both Laughlin and Homestead.

At the 2011 Sustaining Military Readiness Conference, sponsored by the Department of Defense, Ms. Lynn Engelman (Manager, Air Force Noise and Encroachment Management Program) gave a presentation on Noisemap. Ms. Engelman's presentation stated, "The two most important [Noisemap input] data points are flight tracks and flight profiles."

In the 1979 verification test at Laughlin, flight tracks and flight profiles for the noise events were not noted. No record was made of the two most important Noisemap input data points.

During testing at Laughlin, two of the four noise monitors failed, and could not be restored to service. Six locations were to have been monitored but, at the test's conclusion, complete data was obtained for only two of the six locations, and incomplete data was obtained at a third location.

The wind shifted during a substantial portion of the testing at Laughlin; approaches and departures switched from their usual direction. "This was causing our measurement period to be not representative of the yearly averaged operations at Laughlin," *Field Studies* notes.

"After the problems encountered at Laughlin AFB," *Field Studies* states, "a less ambitious test was planned for Homestead AFB." Monitoring locations were reduced to three. Of the three noise monitors used, one failed the first day, but was subsequently repaired and returned to service. Another noise monitor was stolen partway through the testing.

At Homestead, flight paths and flight profiles were noted for most—but not all—noise events. Despite incomplete data due to problems with the noise monitors, test results were not as flawed as they had been at Laughlin.

Field Studies describes the results: "The data at Laughlin showed good agreement at one location and a definite disagreement at two other sites between the measured and Noisemap predicted values." Of Homestead data, *Field Studies* notes "differences between measured and Noisemap predicted DNLs."

The discrepancies between measured noise levels and Noisemap's predicted levels were resolved by entering different input data into Noisemap. This produced different predicted levels. "After correcting the erroneous operation inputs to Noisemap," *Field Studies* states, "we had excellent agreement at both measurement locations."

This is an ingenious—if not quite honest—solution to the problem. If Noisemap produces erroneous outputs because its software architecture is flawed, change the input data until the outputs match the measured noise levels. With this, *Noise Studies* can conclude, "we had excellent agreement."

The information in the paragraphs above should provide an answer to the basic question: Is Noisemap reliable?

Consider these points:

- The only known test of Noisemap's reliability was conducted in 1979.

- Verification testing was conducted with equipment that is very primitive by today's standards.

- Noise was measured of T-37, T-38, and F-4 trainer aircraft, which date from more than a half-century ago. Their noise profiles are quite different from the noise profiles of TFT's current and proposed fixed-wing and rotor aircraft.

- Many problems were encountered during the test's noise measurements, which resulted in incomplete data at both Laughlin and Homestead sites.

- Actual noise measurements did not always correlate with Noisemap's predictions of noise. Discrepancies were resolved by altering the data that was input to Noisemap.

- The verification test was performed with an early version of Noisemap. The current version of Noisemap is several generations removed from the 1979 version.

Noise analysis is the foundation of the TFT EA. Noisemap is the foundation of the EA's noise analysis.

Again, the question: Is Noisemap reliable?

Now, the answer: Nobody knows.

Because the reliability of Noisemap is unknown, the significance of TFT's noise impacts is unknown. The TFT EA cannot conclude that noise impacts are not significant and that a FONSI is justified.

Noisemap 6.0, which is cited above, states "Noisemap is a key factor in the Air Force defense against noise related lawsuits." To ensure the final decision regarding the TFT EA will withstand legal challenges, the EA must provide substantive verification—which will include actual test results—that the current version of Noisemap is reliable.

Sincerely,

Gary A. Hunter
Resident of Tucson

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 10:08 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Comments on Environmental Assessment of Total Force Training
Attachments: acna_osb_ea_comment_20141123.pdf

-----Original Message-----
From: les_p_hackenslash@yahoo.com [mailto:les_p_hackenslash@yahoo.com]
Sent: Monday, November 24, 2014 1:39 AM
To: 355 FW/PA Comments
Subject: Comments on Environmental Assessment of Total Force Training

Howdy:
Attached plz find, in PDF format, Arroyo Chico Neighborhood Association's comments on the TFT (fka OSB) EA.
Thank you,
Les.

enc: acna_osb_ea_comment_20141123.pdf (~281KB, two pages, PDF format)

ARROYO CHICO NEIGHBORHOOD ASSOCIATION

23-NOV-2014

TO: **TFT EA Comment Submittal**
355th Fighter Wing Public Affairs
3405 South Fifth Street
Davis-Monthan AFB, AZ 85707
355fw.pa.comment@us.af.mil

FR: **Arroyo Chico Neighborhood Association**
c/o Les Pierce, President
2727 East Beverly Drive
Tucson, AZ 85716
les_p_hackenslash@yahoo.com

RE: **Comments on Environmental Assessment of Total Force Training**

Hello:

It is with great concern that we take pen in hand to comment on the recently released Draft Environmental Assessment (DEA) conducted on the Operation Snowbird (now called Total Force Training, herein TFT) program operated at Davis-Monthan Air Force Base (DMAFB) and Tucson International Airport (TIA). We believe the "Finding of No Significant Impact" (FONSI) was arrived at in error.

To put our comments in context, the Arroyo Chico Neighborhood Association (ACNA) is comprised of roughly 1500 homes and businesses within a .75-square-mile area approximately 2.5 miles northwest of the end of DMAFB's runways. The subdivisions in ACNA's southeast corner were platted in 1928 and 1929, with most homes being constructed in the 1940s and 1950s. We are economically, racially, and chronologically diverse, with many of our elders still living in the homes they bought to raise their now-grown children.

ACNA is directly underneath the northwest approach and departure flight path for DMAFB fixed-wing aircraft, and almost one-third of a square mile within ACNA boundaries is now in the DMAFB 65-69 Ldn high-noise zone and/or the DMAFB accident potential zone. These zones were extended to their current sizes ten years ago, in 2004, to cover between 650 and 675 additional properties within ACNA.

Against this backdrop, the use of 2009 as a baseline for this DEA appears to have been done in error since the cumulative noise impacts prior to that date (i.e., those impacts which prompted an expansion of the 65-69 Ldn noise contour) are not considered in this assessment as required.

Further, using 2009 as a baseline eliminates from consideration any programs in effect between the start of Total Force Training (then called Operation Snowbird) in 1978 and 2009 such as the Multi-Service program or the Foreign Military Sales Program which contribute to DMAFB's aircraft noise impact to the surrounding community.

Like many neighborhoods in midtown Tucson, ACNA has endured many assaults over the years, including:

(a) Increased operations at the Union Pacific Railroad yard to the southwest (length of trains, frequency and hours of throughput) provides noise around the clock, diesel exhaust, and vibration.

(b) East 22d Street on our south edge has been widened, creating more traffic noise and pollution, and disconnecting neighbors and families; another planned widening will further increase these harms and has already spurred the anticipatory relocation of ten families and demolition of their homes.

(c) When Julia Keen Elementary School was closed (it was "in the way" of the expanded DMAFB 70-74 Ldn high-noise zone), the students, no longer able to walk to their neighborhood school, have been being bused or driven to nearby elementary schools (such as Robison Elementary in ACNA) which increases the vehicular traffic (noise, pollution, accident risk) around those schools.

(d) Broadway Blvd on ACNA's north edge has been "going to be widened" since 1987, and this uncertainty has led to disinvestment, predatory speculation, and the loss of nearby small businesses and service providers to which residents used to be able to walk. These plans now appear to be coming to fruition, which will mean demolition of historic structures, disconnection from neighborhoods north of Broadway, and increased traffic noise, pollution, and accident risk.

(e) When the housing speculation bubble burst, ACNA suffered with the rest of midtown a slew of foreclosures, speculator buying, and an increase in the number of rental properties.

Of course, none of this is the fault of DMAFB or the Air Force. However, this is the "baseline" of cumulative impacts to which increasing DMAFB aircraft noise must be added in order to get a true assessment of how TFT will effect ACNA and other similarly situated surrounding neighborhoods.

Also troubling is the DEA use of Day-Night Level noise averaging (DNL) as its sole method of noise analysis. DNL is a long-term average, and does not adequately represent the very loud short-duration noise of aircraft passing over our homes. The military does not use 24-hour averages to determine what hearing protection should be used by runway and other aircraft personnel because that method would greatly understate the actual impacts to soldiers' hearing. Why should the surrounding community and neighborhoods be subjected to a less rigourous measurement? The DEA must use additional methods of noise analysis, as described in Department of Defense publications.

We look forward to a revised EA that makes a more realistic assessment of the impacts of the Total Force Training program on the neighborhoods surrounding DMAFB and the rest of midtown Tucson.

Thank you,

Les Pierce

Les Pierce
President, Arroyo Chico Neighborhood Association

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:39 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Draft EA - Total Force Training Mission for Visiting Units - Davis-Monthan

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From: C Tanz [mailto:azctanz@gmail.com] On Behalf Of Chris Tanz
Sent: Monday, November 24, 2014 8:24 PM
To: 355 FW/PA Comments
Subject: Draft EA - Total Force Training Mission for Visiting Units - Davis-Monthan

TO:
TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
Davis-Monthan AFB, Arizona 85707.

Re: The Draft Environmental Assessment for the Update and Implementation
of the Total Force Training Mission for Visiting Units
(Operation Snowbird, Multi-Service, and Foreign Military Sales)
Davis-Monthan Air Force Base, Arizona

To Whom it May Concern:

I appreciate the opportunity for the public to make comments on the EA, and I would like to register the following concerns about the current draft:

<u>1. Noise level measurements</u>
The EA provides data based on <u>average</u> levels of noise over a 24-hr period. As a former research psychologist, I know that day-night average sound level figures (DNL) tell only part of the story of the impact of noise on humans. Hearing, blood pressure, sleep patterns, general health, quality of life and productivity, are all profoundly affected by exposure to <u>peak noise</u>. The level, frequency and duration of peak noise are all significant, and not adequately addressed in the EA.

Procedures do exist for measuring and assessing the impact of “startle” events. The National Institute for Occupational Safety and Health (NIOSH) has developed standards to protect the hearing of people who are exposed to high levels of noise at work. They are in use by various branches of the military to determine what ear protection personnel need to have to avoid hearing loss. These considerations should also apply in the civilian context.

As a specialist in children’s cognitive development and language acquisition, I am also especially concerned that the impacts of aircraft noise on children’s learning and cognitive development in the zones proximal to DM AFB have not been adequately addressed in the EA. These concerns arise in the special context of an Air Force Base that is seeking to expand its flight training missions despite being located within the boundaries of a major metropolitan area. The fact that these training missions land and take off over homes and schools is problematic. Expanding to other types of missions would be more appropriate in this location.

<u>2. Data baseline (Cumulative impacts)</u>
We have become aware that the EA uses data from 2009 as a baseline for analyzing the impacts of training missions at DM. There has not been any environmental assessment of the Snowbird Program since 1978. Choosing an arbitrary starting point to measure impacts artificially minimizes the effects of the program and violates the principles of an EA.

The concept of cumulative impact comes from the Council on Environmental Quality (CEQ), the agency under the President of the United States that oversees NEPA.
CEQ Regulation 1508 Sec. 1508.7 Cumulative Impact states:

"Cumulative Impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impact can result from individually minor but collectively significant actions taking place over a period of time"

<u>3. Future changes in aircraft (Cumulative impacts)</u>
The EA also fails to provide an adequate assessment of the impacts of aircraft that are candidates for future basing at DM. This amounts to neglecting the effects of "*reasonably foreseeable future actions*" as required in the CEQ regulation quoted above.
Air Force data show that the aircraft that are likely to replace the A-10 over time (the F-18, F-22, and possibly the F-35) are respectively 3 to 4 to 8 times louder than the A-10. The Air Force should analyze the effects of these possible changes in aircraft in its assessment of the impacts of its "preferred alternative", the expansion of operations of visiting units at DM.

I join many other members of this community in urging the Air Force to prepare a full EIS based on proper assessment of the impacts of the planned expansion of training missions and likely changes in aircraft on the health and safety of the public – and on property values, quality of life in the central city, and on the viability of other core civilian institutions and economic engines of the community such as the University of Arizona, the tourism industry, the burgeoning biotech industry, etc.

Respectfully,
Chris Tanz, Ph.D.
Tucson, AZ 85716

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:45 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: El Encant Comment on TFTP EA
Attachments: TFTP EA comment.docx

-----Original Message-----
From: Garcia, Jose D - (jdgarcia) [mailto:jdgarcia@email.arizona.edu]
Sent: Monday, November 24, 2014 5:24 PM
To: 355 FW/PA Comments
Subject: El Encant Comment on TFTP EA

Attached are our comments on the Total Force Training Plan Environmental Assessment draft.

JD Garcia

President, EEEHA

El Encanto Estates Homeowners Association

10 N Calle Portal, Tucson, AZ 85716

Phone: 520 327 3946 jdgarcia@email.arizona.edu

November 23, 2014

ATTN: TFTP EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Gentlepersons,

We appreciate the opportunity the Air Force has provided the citizens of Tucson to review and comment on the Draft Total Force Training Environmental Assessment.

The Draft TFTP EA finally concludes there is no significant impact (FONSI) as a result of doubling the number of training flights, compared to OSB flights using a 2009 count base, and including several types of aircraft not currently used at DMAFB, all of which are much noisier than the A-10, which is at present the prevailing aircraft here. The analysis dealing with noise only considers the 24-hour average noise level changes due to the TFTP, and not the impulse noise effects on the surrounding population of Tucson. There is a DoD regulation which requires that care be taken to protect military personnel who are subjected to impulse noise levels with peaks higher than 85 dBA on a regular basis. We think that civilian personnel subjected to such levels should also be protected. No data or analysis is provided to address this, which seems likely to be occurring in several residential areas of Tucson near DMAFB, particularly just NW of the base. Such an analysis needs to be done to see whether the FONSI is really true.

It also will be a surprise to those living in the 128 new residences now will be added to be included within the 70 dBA contours, that there is no significant impact on their lives. The Air Force should analyze this further, and if true, acknowledge that there is likely to be a disproportionate impact on minorities as a result of the implementation of the TFTP. Given the demographics analysis in the draft EA, this appears likely to be true. If so, the Air Force should be prepared to mitigate these effects for people within the 70 dBA contours, and those efforts should be included as part of the TFTP.

We believe that, because DMAFB is imbedded in a metropolis of about a million people, missions assigned to the base should avoid the operations and overflights by aircraft noisier than the A-10. We can think of several such missions that would be more suitable than those proposed in the TFTP.

Sincerely,

President, EEEHA

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 11:16 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Noise from approaching aircraft

From: Sharon Barr [mailto:sharonalaska3@gmail.com]
Sent: Monday, November 24, 2014 10:10 AM
To: 355 FW/PA Comments
Subject: Noise from approaching aircraft

I live directly under the flight path of approaching aircraft. (see address below).

The sound of aircraft overhead routinely sets off car alarms in our parking lot. I know (from experience on a military contract) that this noise level would require ear protection if it were to be experienced in a military environment and therefore I cover my ears; my neighbors are not fortunate enough to understand this.

However, my objection is not to training in general or any particular aircraft, but to the expansion of flying hours. All activity used to cease by 10PM. Recently freighter aircraft have been landing between 10 and 11:15 PM at extremely low altitudes; many of the people in my co-op are elderly and go to bed before this time. I gave up trying to sleep until 11PM.

I would ask that exercise hours be restricted to between 8AM and 10PM.

Thank you.

Sharon Barr
1776 S Palo Verde Ave
Apt. M113
Tucson, AZ 85713

(575) 519-1070

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 4:55 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: Saguaro National Park comments on DM TFT EA
Attachments: SNP comments pg1.PDF; SNP comments pg2.PDF

-----Original Message-----
From: Kline, Natasha [mailto:natasha_kline@nps.gov]
Sent: Monday, November 24, 2014 3:16 PM
To: 355 FW/PA Comments
Subject: Saguaro National Park comments on DM TFT EA

Attached please find comments from Saguaro National Park regarding the Air Force's Environmental Assessment for the update and implementation of the Total Force Training Mission at Davis-Monthan Air Force Base .

Natasha C. Kline
Biologist
Saguaro National Park
3693 S. Old Spanish Trail
Tucson, AZ 85730
ph: 520.733.5171

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:47 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: TFT EA COMMENT SUBMITTAL - Comment and Objection - Lochrin/Hunter
Attachments: RevEA Comment_AmericansFLivableComm.docx

-----Original Message-----
From: mlochrin@cox.net [mailto:mlochrin@cox.net]
Sent: Monday, November 24, 2014 4:41 PM
To: 355 FW/PA Comments
Cc: Hunter, Molly
Subject: TFT EA COMMENT SUBMITTAL - Comment and Objection - Lochrin/Hunter

To Whom It May Concern,

We refer to ~ and support ~ the attached ALC/ACLPI (Americans for Livable Communities) comment letter that argues that the ~ 'Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base' Arizona ~ was poorly done according to experts and that an EIS clearly needs to be done.

My wife, a professor at the University of Arizona, and I, an architect by training, who live near the University campus are concerned that the proposed increase in allowed flights to and from D-M AFB of vastly noisier jets than the A-10's will :
1. re. PROPERTY VALUE
- (with the proposed mission changes) decrease immediately and greatly our property value, and the value of recent commercial developments which have sought to rejuvenate our downtown.
2. re. NET LONG TERM JOBS
- lead to a lowering of the development potential of the City of Tucson, with reduced NET business interest, NET lower wages and NET job growth long term. We are especially concerned about the spoiling of quality of life through jet fighter noise pollution that, in turn, would lead to reduced appeal of the University of Arizona campus for students and University employees. The same concern is valid for the TOURISM within the Tucson valley which DIRECTLY contributes far more to our local economy than Base-related civilian business activity contributes.
3. re. QUALITY OF LIFE
-lead to a large drop in the quality of life and thus attractiveness of the City for people who might otherwise relocate here.
4. re. TUCSON CITIZENS GOOD WILL
- lead to a lowering of public opinion of, an antagonism towards, the USAF by

the citizens of the City of Tucson.

My wife and I are not against the Base remaining open for missions that are no noisier or riskier for us on the ground below than the current A-10 and C-130 missions. We would not object to other newer types of aircraft that meet the same bar. When it comes down to it, D-M AFB is in the wrong location for the likes of F-35 fast jets, and a new base may be needed to access the Goldwater Range.

We feel the above mentioned EA does in no way do justice to the negative environmental effects of the above proposed Flight Training capacity IN ADDITION to the current environmental burden to citizens, and should, for the sake of civilian good will acknowledge ALL the secondary economic impacts which will flow directly from the environmental impacts.

This e-mail will be forwarded at a later date to civic leaders in Tucson,
State Representatives, Congressional Representatives and the appropriate USAF offices in Washington.

Thank You, Yours Sincerely,

Mark Lochrin & Molly Hunter
322 North PlumerAve
Tucson AZ 85719

Americans for Livable Communities
P. O. Box
Tucson, AZ 857.

Arizona Center for Law
in the Public Interest
2205 E. Speedway Blvd.
Tucson, AZ 85719
jherrcardillo@aclpi.org

November 24, 2014

Via electronic mail and first class mail
ATTN: TFT EA COMMENT SUBMITTAL,
355th Fighter Wing Public Affairs
3405 S Fifth Street,
Davis-Monthan AFB, Arizona 85707.

Re: Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona

To Whom it May Concern:

This letter represents the response to the solicitation of comments on the draft Environmental Assessment for the Update and Implementation of the Total Force Training ("TFT") Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona ("Revised EA") from Americans for Livable Communities ("ALC") and the Arizona Center for Law in the Public Interest ("Center").

ALC is an alliance of concerned citizens whose mission is to protect and enhance the livability, safety, property values, and economic viability of our communities. The communities we represent include homeowners who live and work in the flight pattern from Davis-Monthan Air Force base and would be affected in a number of ways if the proposed expansion of the TFT program is implemented. Several of the current members of ALC have also been active in Tucson Forward, a non-profit organization that was formed several years ago to protect Tucson and its neighborhoods from health damaging noise and safety concerns related to overflights from Davis-Monthan.

The Center is a nonprofit law firm dedicated to ensuring government accountability and protecting the legal rights of Arizonans. It frequently works with community groups that are concerned about the environmental impacts of proposed government projects or actions, and assists them in navigating the NEPA process.

In reviewing the Revised EA, it is important to consider it in context. Operation Snowbird ("OSB") began in 1975 as a way to train Air National Guard pilots based in northern states during the winter months. Over the years, the program evolved into year-round training; however, the last NEPA analysis of the program was performed in 1978, before it expanded its schedule. Thus the environmental impacts of extending the program year round were never evaluated before the change was made. Nor were other significant changes to the program, such as the number and type of aircraft flown by participants, evaluated prior to their implementation. Consequently, in 2010, in response to questions raised by members of the public regarding the lack of the required NEPA analysis, the Air Force initiated an updated NEPA analysis. In July 2012, the Air Force released for public comment its Draft Environmental Assessment for the Proposed Update and Implementation of the National Guard Bureau Training Plan 60-1 in Support of Operation Snowbird Davis-Monthan Air Force Base, Arizona ("original EA"). The public comment period for the original EA closed in October 2012. The Center, along with a citizen-based organization, Tucson Forward, submitted extensive comments on the original EA ("Comment Letter I"). In their capacity as members of Tucson Forward, several members of ALC contributed to or were otherwise involved in the drafting of Comment Letter I. After the close of the comment period, the Air Force announced that it was revising the EA, purportedly to respond to the concerns expressed during the public comment period. It took the Air Force nearly two years to revise the EA.

Unfortunately, after reviewing the Revised EA both the Center and ALC have concluded that the EA continues to be incomplete and inadequate and fails, utterly, to support the Finding of No Significant Impact ("FONSI"). For the reasons set forth below, we urge the Air Force to rescind the FONSI and prepare a full Environmental Impact Statement, as the law requires, or, at minimum a revised EA.

- **Introduction/General Overview of Law:**

The National Environmental Policy Act ("NEPA") has "'twin aims. First, it places upon [a federal] agency the obligation to consider every significant aspect of the environmental impact of a proposed action. Second, it ensures that the agency will inform the public that it has indeed considered environmental concerns in its decisionmaking process.'" *Kern Bureau of Land Mgmt.,* 284 F.3d 1062, 1066 (9th Cir. 2002)(quoting *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc.,* 462 U.S. 87, 97 (1983)). NEPA is not substantive. It does not require that agencies adopt the most environmentally friendly course of action. *Kern,* 284 F.3d at 1066. Rather, "[t]he sweeping policy goals . . . of NEPA are . . . realized through a set of 'action-forcing' procedures that require that agencies take a 'hard look at environmental consequences.'" *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 350 (1989)(quoting *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n.20 (1976)).

In this case, the Air Force has failed to meet either goal. As discussed more fully below, the environmental analysis undertaken by the Air Force in the Revised EA grossly understates the impacts of the proposed action by, according to the Department of Defense's own policies, failing to fully and fairly evaluate the noise impacts on the quality of life and health of Tucson citizens who live within the flight path used by TFT. Second, instead of informing the public that the Air Force has, indeed, considered the environmental impact of its decision making, the Revised EA only confirms that the agency has instead sought to mislead the public about how extensive the impacts may, in fact, be. NEPA requires more—substantially more.

- **The Discussion of Noise Impacts on the Affected Community Remains Inadequate Because it is Fundamentally Incomplete in Several Important Ways.**

Agencies are obligated under NEPA to insure the professional integrity, including scientific integrity, of the discussions and analyses in their documentation. 40 C.F.R. §1502.24. The Air Force has fallen short of this requirement in several respects in regards to the important issue of noise impacts.

1. <u>The assumptions underlying the day-night average sound level (DNL) have a very high likelihood of changing, thus significantly affecting the DNL projections and potentially changing the EA's analysis and the conclusions of the draft finding of no significant impact.</u>

The draft noise analysis report is the basis for the EA's DNL contours and all other results of noise analysis. Sec. 2.1 of Appendix C lists five stages of noise analysis for this EA. To date, the first three stages are complete, and part of stage 4 is complete. Stage 5 has not begun. The Draft EA was released before the noise analysis was complete.

Further, according to Sec. 2.1, 2.2, and Table 2-1 of Appendix C, the report is based on seven assumptions. Now that the Draft EA has been released, DMAFB and ACC will review the seven assumptions. The review may change some or all of them. If any assumption changes, the noise analysis report will change which, in turn, could affect the EA, potentially in important ways. Table 2-1 of Appendix C assesses the likelihood that each assumption will change after DMAFB and ACC review it. In addition, the table assesses the impact that an altered assumption will have on the report and hence, on the EA. For example, the likelihood that Assumption 1 will change is <u>high.</u> And if Assumption 1 changes, its impact on the report and importantly, on the analysis in the EA, will be high.

The discussion in this section about these assumptions notes that they were made to enable noise modeling within the agreed-upon timelines. In fact, this analysis is already many years' late. The Air Force should complete the final report and revise the underlying analysis in the EA and recirculate it to the public for review and comment as either a supplement to the EA or as part of a draft EIS.

2. <u>The DNL projections are not supplemented with other metrics, per applicable DOD guidance.</u>

The Revised EA uses only one method to analyze the impacts of annoyance to the community from noise: DNL. The EA justifies this on its page 3-4: "DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974)." This USEPA recommendation is forty years old, and while we understand that DNL analysis is still commonly used, acoustics experts, <u>most importantly within the Department of Defense</u>, have recognized during the past four decades that DNL analysis tells only part of the story. For environments affected by short-duration, high-SEL events such as aircraft noise, DNL analysis fails to describe the most serious impacts. The only use of any other metric found in the EA is in Table 3-1 which presents "Representative SEL for Typical Aircraft under Flight Track at Various Altitudes," but this is in the affected environment section and SEL analysis is never presented in the impacts analysis.

In a 2009 publication, DOD forthrightly recognized the shortcomings of correlating DNL and the FICON Curve (updated from the Shultz Curve) for predicting community annoyance. C*ommunity Annoyance Caused by Noise From Military Aircraft Operations* (Department of Defense, December, 2009) (available at http://www.denix.osd.mil/dnwg/upload/Master-ANNOYANCE-12-09.pdf), Issues identified regarding DNL and the FICON Curve include "methodological questions, errors in measurement of both noise exposure and reported annoyance, data interpretation differences, and the problem of community response bias . . .[and] an extraordinary amount of scatter in the data." *Id.* at 5.

In recognition of the limitations of DNL and the FICON Curve as a useful methodology for prediction, DOD published a guide to using supplemental metrics, "to guide the Military Services in providing more useful information on the noise environment than is available through solely using the long-term cumulative metrics such as DNL." *Improving Aviation Noise Planning, Analysis and Public Communication with Supplemental Metrics* (December, 2009) at 1-1.(emphasis added)(hereinafter "*Supplemental Metrics*")(available at http://www.denix.osd.mil/dnwg/upload/DNWG_Supplemental-Metrics-Report_December-2009.pdf).

As stated in *Supplemental Metrics*:

> When using DNL to communicate noise exposure to the average citizen residing near a military airfield, a typical response is, "I don't hear averages, I hear individual airplanes." Airport neighbors often become angry and frustrated trying to understand explanations of noise exposure solely in terms of average sound energy with the DNL metric, particularly when they are trying to grasp the impact of . . . increased operations and aircraft changes.

Id. at 2-1. While the guide is clear that DOD is not replacing DNL, it provides considerable rationale for supplementing DNL with several other methodological approaches that are intended to provide more useful information on the noise environment than is available through solely using the long-term, cumulative metrics such as DNL. Importantly, the need for supplemental noise metrics is characterized as being two-fold: "(1) to produce more detailed noise exposure information for the decision process; and (2) to improve communication with the public about noise exposure from military activities." *Id.* at 1-1. DOD's articulation of need for supplemental metrics mirrors perfectly the purposes of the NEPA process.

Along with *Supplemental Metrics*, DOD also published a Technical Bulletin on *Using Supplemental Noise Metrics and Analysis Tools* (December, 2009)(available at http://www.denix.osd.mil/dnwg/upload/Master-Using-Supplemental-Metrics-12-09.pdf). The Bulletin provides detailed guidelines for the analysis and presentation of

- Maximum A-Weighted Sound Levels (Lmax)
- Sound Exposure Level (SEL)
- Equivalent Sound Level
- Time Above a Specified Sound Level (TA)
- Number-of-Events Above a Specified Sound Level (NA)

Id. at 7; *See also Supplemental Metrics* at 5-4 through 5-7. Guidelines on how to use these supplemental metrics are published in Table 6-1. *Supplemental Metrics.* at 6-3. While DNL is still characterized as the best metric for long-term annoyance, DOD warns that, "**it is inadvisable to use the average annoyance curve [Schultz/FICON] to predict the specific number or percentage of the local exposed population who are expected to be highly annoyed by aircraft operations at a given DNL**." *Id*. (emphasis in original). The Revised EA does contain what it characterizes as "representative SEL" for some aircraft to be used at DM, EA at 3-5, but this generic listing of SEL levels is hardly an analysis of SEL impacts of the TFT aircraft, and even omits many of the planes expected to be flying under the auspices of the TFT.

As DOD explains in *Supplemental Metrics*:

> While the Federal agencies have accepted DNL as the best metric for land use compatibility guidelines, reducing the description of noise exposure to a single value of DNL may not help the public understand noise exposure. Simply looking at the location of their home on a DNL contour map does not answer the important questions: how many times airplanes fly over, what time of day, what type of airplanes, or how these flights may interfere with activities, such as sleep and watching television. The number and intensity of the individual noise events that make up DNL are critically important to public understanding of the effects of noise around airports. What is needed is a better way to communicate noise exposure in terms that are more easily understood. Supplementing DNL with additional metrics will help the public better understand noise exposure.

Supplemental Metrics at p. 2-1.

In *Supplemental Metrics* the DOD recommends that results of the above metrics be presented in tables and/or as contour lines on maps (just as the TFT EA presents DNL contour lines) *Id.* at 5-10. The publication includes several real-life examples of both. The contour maps are particularly striking. At a glance, they provide very important information that is totally absent from DNL metrics. For example, at Marine Corps Air Station Cherry Point in North Carolina, the contour line for NA above 90 dB SEL extends eight and a half miles beyond the DNL 65 dB contour line. *See Id.*, Figure B-6 at p. B-16. This is crucial information. As *Supplemental Metrics* explains, the above metrics "are as important to the project stakeholders as they are to communicating with the general public, because they enable the project managers and decision makers to make better-informed decisions." *Id.* at 5-1.

Further, in relationship to the ongoing program at DM, residents have noted ongoing incidents in which aircraft from DM are flying outside of the flight paths presented in the EA. Indeed, Air Force representatives have stated that the pilots are allowed to fly anywhere in the Tucson. For example, in a response to a citzen's complaint about the noise from overhead aircraft, DM Public Affairs Officer, Sarah R. Ruckriegle, 1st Lt. wrote:

> Our pilots operate in dynamic airspace with a myriad of constantly changing factors that will affect their actual ground track. While they follow patterns that are reflected in graphics, which have been provided to the public by the base, there are no airspace restrictions,

> regulations, agreements or other mandates that restrict our pilots to specific ground tracks or street intersections. The graphics we have provided are intended to be tools to help residents and other interested parties become familiar with our most common traffic flow and the approximate vicinities where they will most commonly see our aircraft.

Letter dated July 29, 2013, attached as Exhibit 1.

Because the impacts to area residents and businesses are not fully represented by the DNL metric, and the affected area is potentially greater than the DNL contour identified in the Revised EA, at least some of these supplemental metrics should not only be considered but should be calculated and analyzed with NOISEMAP. Because the TFT EA uses NOISEMAP for its DNL metric, the inputs for these additional metrics may already be complete. Speech interference and classroom speech interference would seem particularly relevant. This analysis needs to be provided for public review and comment in a revised EA or draft EIS.

It is worth noting that failure to include these metrics can lead to litigation. *Supplemental Metrics* describes one successful lawsuit:

> The City of Oakland CA prepared the required Environmental Impact Report (EIR) to analyze the consequences of their proposed Airport Development Plan for the Metropolitan Oakland International Airport. Its adequacy in defining nighttime noise impacts solely with the DNL noise metric was challenged in court by a citizens group and in its decision, the California appeals court set a precedent (at least in California) that DNL 65 dB is not a sufficient criteria to use in Environmental Impact Reports for this purpose and that single event noise levels must also be considered.

Supplemental Metrics at C-12. To avoid a similar challenge here, the Air Force should consider which recommended metrics in *Supplemental Metrics* are most appropriate for the proposed TFT program, utilize them, and present the results in a revised EA or draft EIS.

3. <u>The EA uses the original Schultz Curve instead of the updated version recommended by DOD.</u>

For some unexplained reason, the Air Force chose to use the original Schultz curve in its analysis of public annoyance from noise exposure (Figure 3-1). As stated in *Supplemental Metrics*, the original 1978 Schultz curve has been updated, and the updated fit "is the current preferred form in the U.S." *Id*. at 3-3 and 3-5. While the differences between the original and updated version are characterized as not being "substantial," there are some differences and there is no explanation offered as to why the version currently accepted by both DOD and the Federal Interagency Committee on Noise as being the preferred model was not utilized. Further, that the state of modeling annoyance curves has advanced beyond either the original or Shultz/FICON curve. Importantly, the Schultz curve has been substantially revised to differentiate among annoyance responses from different noise sources. Technical information regarding the update is provided in a separate comment letter from Mr. Gary A. Hunter, a professional civil engineer, dated November 24, 2014 and incorporated by reference.

In short, the use of a 34 year-old model to characterize annoyance to the community meets neither the standard necessary for professional integrity under NEPA nor the standards necessary to meet the Information Quality Act, Pub. L. 106–554, or the Department of Defense's guidelines under that Act:

> Components should not disseminate substantive information that does not meet a basic level of quality. An additional level of quality is warranted in those situations in involving influential scientific, financial, or statistical information. This additional level of quality for influential scientific, financial, or statistical analytical results requires that such information be "capable of being substantially reproduced.

Department of Defense Information Quality Guidelines, revised, 2007. The analysis should be revised using the most current, credible models available and presented for public review and comment in a revised EA or draft EIS.

4. The EA fails to explain the omission of the Advanced Acoustic Model in the applicable NOISEMAP application.

The Aircraft Noise Analysis proffered to support the TFT EA explains that the NOISEMAP suite of noise models includes three modules and states that only two of the modules were used for this analysis, (Appendix C, Noise Analysis, pp. 11-12). The Advanced Acoustic Model was omitted. There is no explanation of why this is the case, leaving the reader to guess at whether this third component has relevance to the TFT program at DM. A revised EA or draft EIS should explain this omission.

5. NOISEMAP's reliability in terms of actual impacts is not assessed.

Finally, the EA presents no information regarding NOISEMAP's actual reliability in terms of on-the-ground impacts. To our knowledge, no testing vis-a-vis actual operational data has taken place to compare actual impacts with NOISEMAP predictions. If such testing has taken place, whether at DM or elsewhere, the Air Force should include that information in a revised EA or a draft EIS.

6. Increased noise impacts to residences in areas exposed to a DNL of between 70 and 74 DB are not discussed.

The Revised EA neglects to analyze the increased noise impacts to the residents most affected by these flights. While the EA states that, "[a]reas exposed to a DNL above 65 dBA are generally not considered suitable for residential use," the contours show flights over residential areas in this zone. (EA at 3-4, Figure 3-2). Yet the EA offers no analysis about the impact of the increase of flights over these residences. This is another example of where the supplemental metrics are critical to accurately evaluate the full impact. Even if there is no change in DNL metrics, an increase in NA metrics would have a tremendous adverse impact on quality of life that is already compromised. The "hard look" required by NEPA includes just this type of analysis.

The revised EA also still fails to identify appropriate mitigation measures as noted in Comment Letter I. The 70 dB zone is an area which particularly commands attention in terms of mitigation. The Air Force has totally failed to identify and analyze mitigation measures. While adoption of mitigation measures is not a requirement of the law, identification and analysis of such measures is part of the required analysis.

- **The Public Process for the Revised EA was Inadequate**

The Air Force's process for public involvement in the Revised EA has been flawed from two perspectives. First, as discussed in detail in the section on noise impacts above and in several sections below, critical analysis has either not been completed or has not been shared with the public. This lack of disclosure inhibits a competent critique of the analysis underlying the Air Force's conclusion regarding the type of impacts which is of the widest concern to the public. We pointed this out in Comment Letter I, stating that, "the public has, as of this date, been unable to obtain the complete noise analysis upon which this EA is based. The Noise Data Collection Review and Validation Study (ACC 2007) referenced in the draft EA . . . . as the '2007 Noise Study' is only a collection of aircraft operations data needed to input a noise prediction model. Missing are the resulting NOISEMAP profiles. It is not possible to comprehensively and accurately comment on the noise analysis when documents cited in the draft EA are mislabeled and incomplete and not available on a timely basis to the public." Comment Letter I at 19.

The same type of omissions are associated with the Revised EA and present a formidable barrier to competent assessment on the part of the public and outside experts. Further, no explanation is given as to the omission of the availability of documentation or the failure to finalize the draft noise analysis report prior to the release of the revised EA. Thus, the public is left without the underlying data and analysis to provide an independent analysis but with the knowledge that, for example, the "risk profile" of the assumption for flight operations other than Visiting Units is very high and that a number of other critical assumptions have a medium to high likelihood of changing when the analysis is finalized (see Table 2.1-List of Assumptions).

Second, the Air Force seemingly forgot the lesson one would have thought it had learned from the original EA when it first ignored the largely Spanish-speaking neighborhood closest to Davis Monthan AFB. One of the rationales for an extension of the comment period on the original EA was the Air Force's late translation of the Revised EA's executive summary into Spanish. Yet, oddly, the Air Force neglected to provide a translation of this EA's executive summary and only provided a translated copy of the draft FONSI. Further, the Air Force has not reached out in any other way to residents of the Julia Keene neighborhood. The residents with known interest in this issue never received a postcard or a letter informing them of the availability of the revised EA, nor a copy of the EA in either English or Spanish. Indeed, it is telling that in the Revised EA, the Air Force gives itself credit for sending notices to disproportionately affected neighborhoods regarding the public scoping meetings and the release of the original EA, but not for the Revised EA. (p. 4-18). The residents in these neighborhoods have not lost interest in actions that affect their health, safety and well being.

- **The Analysis of Cumulative Effects Continues to Be Missing and/or Inadequate**

In Comment Letter I on the original EA for the OSB program, we pointed out numerous deficiencies in the cumulative impacts analysis for past, present and reasonably foreseeable future actions. We observed that the Air Force that it had "a particular burden in relationship to the past and present activities undertaken in OSB because the Air Force failed to comply with NEPA at the time significant operational and programmatic changes were made a number of years ago." Comment Letter I at 14. We also reminded the Air Force that, "the CEQ regulations do not just require the identification of actions having impacts on the same resources; they require analysis of those impacts" and noted that the EA did not provide such analysis. Comment Letter I at 14. We stated that, "the Air Force needs to substantially rework the cumulative effects analysis" and that when done appropriately, we believed the analysis would, in fact, trigger a determination of significance, thus requiring preparation of an EIS. *Id.* Whether that is the case remains unknown, of course, because the Air Force has failed to publish an adequate analysis of cumulative effects.

In regards to cumulative impacts of past actions, the Air Force implies, in the Revised EA, that commentators are seeking analysis of aircraft that are no longer flying, (p. 2-5). That is not correct. What we actually stated and still stand by is that the Air Force must analyze OSB activities from 1978 through the present in two ways: i) to the extent that aircraft flying now were not being utilized in the OSB program as of 1978, that analysis must now be provided as part of the cumulative effects of past actions, as appropriate and present actions; ii) to the extent that aircraft not flying now were, at some point between 1978 and the present utilized in the OSB program, the Air Force should determine whether those the impacts of those aircraft are the same or very similar to aircraft now being proposed to be added to the OSB program, and if so, determine whether analysis of those impacts would be a useful addition to the analysis for the decision maker and the public.

Unfortunately, in the Revised EA any analysis of cumulative effects related to present and reasonably future actions remains missing in action. The Revised EA continues to merely identify actions without providing the analysis of the synergistic effects of those actions combined with the TFT program. Indeed, with the very minor addition of the mention of air shows, the analysis is essentially unchanged from the original EA. Neither the reader nor the decision maker are any better informed about the cumulative effects of the flights covered under the TFT program, other daily flight operations, CBP and TIA flights, etc., than they were before reading the Revised EA. Indeed, in Section 5.2, "Cumulative Effects Analysis," the statement is made that overlaps of use of military airspace "has not resulted in cumulative impacts" (p. 5-4). This suggests that the writer may believe that cumulative effects related to noise only occur if there are several flights in the vicinity of the same airspace at the same time. To the contrary, noise intrusions, whatever the cause of origin, can have cumulative effects on human beings through exposure to single noise events over a period of time. As discussed in the next section, a credible assessment of the health effects of noise would shed light on the true nature of the cumulative effects of the TFT program in combination with other noise.

- **The Revised EA Inexplicably Continues to Ignore Health Impacts.**

NEPA requires federal agencies to assess the potential impacts of their proposed actions. Federal courts are deferential to agencies' analyses in areas of their expertise provided that agencies insure professional integrity, including scientific integrity, of the discussion and analyses, even when there is scientific disagreement. Agencies are free to reject critical comments on their analysis so long as credible opposing views are identified and an agency explains why comments do not warrant further agency response, "citing the sources, authorities, or reasons which support the agency's position. . . ." 40 C.F.R. 1503.4; *see also*, *Committee for Nuclear Responsibility v. Seaborg*, 463 F.2d 783, 787 (D.C. Cir. 1971).

What an agency is not free to do is simply ignore an entire category of impacts with no explanation. In Comment Letter I, we addressed in some detail the Air Force's failure to address health impacts of the current and proposed flights under the OSB, now the TFT, program. Comment Letter I at 4-5. Broadly speaking, we identified two types of health impacts. First, we discussed the "considerable body of professional literature on the health impacts of noise," cited current work done on this issue and pointed to literature on the subject. Secondly, we raised our concerns regarding black carbon deposits found over homes within the flight pattern and epidemiological research linking ultrafine particles contained in jet fuel with adverse human health impacts. *Id.* at 5.

In regards to the health impacts of noise, four days after Comment Letter I was submitted, Harvard School of Public Health and Boston University School of public health released a study analyzing noise impacts from 89 airports in the United States and utilizing data for approximately six million study participants. Noise levels were estimated "at the centroid of each census block surrounding each of the 89 airports out to a minimum of 45 dB . . . ." The study "found a statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular diseases among older people living near airports. This relation remained after controlling for individual data, zip code level socioeconomic status and demographics, air pollution, and roadway proximity variables." Correia, Andrew W., Peters, Juenette L., Levy, Jonathan, Melly, Steven, Dominici, Francesca, "Residential Exposure to Aircraft Noise and Hospital Admissions for Cardiovascular Diseases: Multi-airport Retrospective Study", BMJ 2013; 347:f5561; available at http://www.bmj.com/content/347/bmj.f5561, (last accessed 10/27/14). A study of individuals living in the vicinity of Heathrow Airport in London reached similar conclusions at about the same time as the American study. Hansell, Anna, Blangiardo, Marta, Fortunato, Lea, Floud, Sarah, Kees de Hoogh, Frecht, Daniela, Ghosh, Rebecca, Laszlo, Helga, Pearson, Clare, Beale, Linda, Beevers, Sean, Gulliver, John, Best, Nicky, Richardson, Sylvia, Elliott, Paul, "Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study." BMJU 2013: 347:f5432, available at http://www.bmj.com/content/347/bmj.f5432 (last accessed 10/27/14).

The Revised EA does characterize "health issues relative to noise and stress" as one of the most frequently cited concerns in comments letters on the original EA. Indeed, of impact issues raised, it was the fourth most common of fifteen issues identified (see Table 1-1). Yet the response to this significant issue was stunningly underwhelming. In the table summarizing responses to comments, health impacts are lumped together with safety risks and never addressed separately (Table 1-2). In Table 2-8, summarizing impacts, health is not even listed, although impacts receiving less attention by the affected public are identified. There are four sentences regarding impacts of noise in the body of the Revised EA (p. 3-4), none of which are specific to impacts of TFT flights over Tucson, and one which is a general statement regarding Air Force noise policy.(p. 3-5). The only other mention of health at all in the EA is in an introductory clause leading to a discussion of safety, as in "Health and safety risks," but with no discussion of health effects. And indeed, health impacts are not even mentioned in the section on cumulative effects.

The Revised EA's response to the concerns about particulate matter is equally unsatisfactory. The only mention of this type of comment at all is in Table 1-2, summarizing responses, in which it is stated that, "DMAFB will take into consideration complaints about black particulate matter accumulating in home AC filters." The Air Force fails to explain how it will take these complaints into account, let alone discuss the nature and impacts of the particulate matter. And Comment Letter I did not refer to air conditioning filters, but rather illnesses potentially related to the particulates.

These paltry responses utterly fail to even acknowledge the substantive comments made regarding this issue, let alone to take the required "hard look" at the potential impacts. The Air Force needs to take this issue seriously and proffer an intelligent response. The Department of Defense long ago recognized that the health effects, both the physiological effects and psychological effects (excluding direct effects on hearing), were important issues in relationship to overflights and noise. While earlier reports noted that, for example, "'[t]he results of early studies conducted in the United States, primarily concentrating on cardiovascular response to noise, have been contradictory," DOD's *Supplemental Metrics,* discussed above, recognized some progress in understanding the health effects of noise and noted that more research was needed. *Supplemental Metrics*,pp. 3-14 - 3-16. The Air Force has an obligation under NEPA to keep itself informed of the latest research results, including, but not limited to the recent reports identified in this letter. 40 C.F.R. § 1502.22(a). "[G]eneral statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." *League of Wilderness Defenders-Blue Mountains Biodiversity Project v. U.S. Forest Service*, 689 F.3d 1060 (9th Cir. 2012), citing *Or. Natural Res. Council Fund v. Brong*, 492 F.3d 1120, 1134 (9th Cir.2007) (internal quotation marks omitted).

- **The Revised EA Still Does Not Adequately Address Impacts to Children.**

In Comment Letter I, we pointed out the fact that the EA failed to include an assessment on children as required by Executive Order 13045 (Protection of Children). The EO requires an assessment of "heath risks and safety risks that may disproportionately affect children." Comment Letter at 3. The revised EA purports to address this comment but does so in a very cursory fashion. For example, Section 3.3.5 is entitled "Protection of Children" and references EO 13045, but the bulk of the paragraph simply discussed the EO requirements, and the reason it was issued. The sole "analysis" included in this section is the assertion that "Schools and day care centers in the region were investigated, and it was determined that no schools and one day care center licensed for up to 60 children are located with the current 65 dBA DNL contour." Revised EA Section 3.3.5, p. 3-23. This assessment, however, falls far short of what is required under EO 13045.

The impact of noise on the cognitive development of children has been recognized in the scientific literature. For example, a 2011 study by the World Health Organization addressed at length the adverse impact that airport noise in particular has on the cognitive development of children. *See* "Burden of disease from environmental noise: Quantification of healthy life years lost in Europe," pp. 45-53 (excerpts attached as Exhibit 2) ("WHO Study"). As EPA has advised in a 2012 memorandum regarding "Addressing Children's Health through Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act," NEPA documents, including environmental assessments, should consider the impact that noise can have on children's health and learning, especially when it occurs near homes, schools, and daycare centers. (available at http://www.epa.gov/compliance/resources/policies/nepa/NEPA-Children's-Health-Memo-August-2012.pdf, last accessed 11/4/2014). EPA advises that noise can impact children's learning and stresses that when evaluating military bases or training, agencies need to consider the impact that an increase in noise will upon residences, schools, or child care facilities. *Id.*

As we pointed out in Comment Letter I, there are several schools within the flight pattern of Davis-Monthan, and one of them, the Griffin Foundation Charter School (elementary and middle school) appears to be barely outside the 65 dB noise contour. Griffin has an enrollment of approximately 400 students, and also includes a day care facility. Other nearby schools while not necessarily as close to the 65dL flight contour are nonetheless close enough to be impacted by the increased noise, a fact that would likely be established if a more comprehensive noise analysis that included the supplemental metrics recommended by DOD were undertken. As noted above, the analysis should include metrics that are specific to classroom noise. For schools (as for so much else), these supplemental metrics are far more important, useful, and revealing than the DNL metric.

Finally, the noise impacts upon children are not limited to noise experienced in the school or daycare setting. The impact on children living within the flight pattern must also be taken into account. Much of the noise contour extends over residential neighborhoods. According to the revised EA, up to 128 single family residences and 4 multifamily residences are within the 65dBA DNL contour alone. Children living in those residences will be adversely impacted by the noise and the Air Force has an obligation under NEPA and EO 13045 to undertake a meaningful evaluation of the nature and extent of those impacts. Nor is the impact limited to children within the 65dBA DNL contour. Impacts to health are experienced at lower levels as well. The WHO study found that levels as low as 30 dB could disturb sleep and result in documented health impacts. *See* WHO Study, Table 4.1 Nocturnal Noise. Because the revised EA fails to even address these potential health impacts on children living within the flight pattern, it fails to comply with EO 13045 and NEPA.

- **The Public Safety Analysis Continues to be Inadequate.**

Comment Letter I raised three issues with respect to the public safety analysis. First we objected to the fact that the safety analysis failed to fully evaluate all potential aircraft that may be participating in OSB. That remains true in the Revised EA. Even though the scope of the analysis has expanded to include programs in addition to OSB, and the Revised EA acknowledges that over the past seven years, 18 different aircraft have been used in TFT (see Revised EA, Table 2-1, p. 2-6), the public safety analysis only considers the risk factors of 8 aircraft. The Air Force offers no explanation for why it did not include all potential aircraft and, in fact, there is no legitimate reason not to. Moreover, although the Revised EA acknowledges the recent decision to beddown 72 F-35A aircraft at Luke Air Force Base, it fails to even consider let alone address the possible inclusion of the F-35A in the TFT operations, even though such participation is reasonably foreseeable.

The second concern raised in Comment Letter I was the narrow scope of the safety analysis. By limiting the analysis to Class A mishaps, the Air Force continues to understate the risk that the proposed action presents to the public. We continue to believe the safety analysis is inadequate and deliberately misleading.

Finally, the third concern was the failure on the part of the Air Force to acknowledge the risks presented by pilots unfamiliar with the Tucson airspace. In its response to comments, the Air Force appears to misunderstand or misconstrue our earlier comment. Our concern was not that the visiting pilots were not properly trained. Our comment, based on first-hand experience of a former air traffic controller, was that even experienced pilots have to adjust to the unique requirements of DM and Tucson geography. As Comment Letter I explained:

> However, what the EA fails to acknowledge is that over the years, the practical experience with OSB pilots has revealed that even after these local area briefings, there is an initial adjustment period at the beginning of each training week where pilot errors are much more prevalent. For example, an occasional error made by visiting pilots is the mistake to turn immediately after take off and not fly a straight-out course as required, often risking an in-air collision with another recently departed aircraft traveling on a parallel departure route off of TUS. Reynolds Decl. ¶10. Another repeated problem area are recoveries instructed to fly the Davis recovery, erroneously flying off the radials of DM tacan and not Tus Vortac. *Id* at ¶11. Also prevalent are aircraft descending earlier than instructed on this recovery. *Id.* at ¶12. These mistakes provide a greater potential for loss of separation particularly closer in to the Tucson airport where due to the already close proximity of the airports, strict adherence to procedures and instructions are needed. *Id.*at ¶13, Such collisions have, fortunately, been avoided in the past because of the vigilance of the Tracon air traffic controllers, but it is a recurring problem that will only be exacerbated by an expansion of the program. *Id.*at ¶14.

Comment Letter I at p. 10. Thus, because it misunderstood or misconstrued the original comment, the Revised EA fails to address this concern and the safety analysis remains inadequate in this regard as well.

All of these safety issues should be fully addressed in either a Revised EA or an EIS.

- **The Environmental Justice Analysis Also Remains Inadequate.**

Comment Letter I addressed at length the inadequacies of the environmental justice analysis in the original EA. Our comments took issue with the Air Force's assertion that it had reached out to the affected communities. We pointed out that this assertion was demonstrably false, and that, in fact, the outreach had been minimal and untimely. Comment Letter I at pp. 11-12. The Revised EA does not correct this misstatement but rather simply repeats it. Revised EA at 4-18; 1-11. Moreover, there was no effort on the part of the Air Force to reach out to the affected communities in connection with the Revised EA. No fliers or post cards advising of the release of the Revised EA were directed to the Julia Keen neighborhood—the neighborhood most directly affected. Rather, the Air Force relied almost exclusively on internet notifications and the DM website, even though low income minority communities are less likely to have internet access. The only Spanish translation prepared in connection with the Revised EA is of the FONSI. That is simply insufficient to allow for meaningful participation by the residents that the Air Force admits are disproportionately affected by the proposed action.

The other problems identified in Comment Letter I, the lack of a surface noise analysis and failure to identify mitigation measures, remain unaddressed in the Revised EA. Thus, we reassert those objections and continue to contend that the environmental justice analysis is woefully inadequate.

- **The Revised EA's Characterization of the "No Action" Alternative is Incorrect**

Comment Letter I explained that:

> Federal regulations explicitly require that environmental review be timely. "Agencies shall integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts." 40 C.F.R. § 1501.2 (2005). Consistent with this requirement, the Ninth Circuit has repeatedly held that dilatory or ex post facto environmental review cannot cure an initial failure to undertake environmental review. *See, e.g. West v. Secretary of the Department of Transportation,* 206 F.3d 920, 925 (9th Cir. 2000) (holding that if completion of the challenged action were sufficient to moot a NEPA claim, an agency "could merely ignore the requirements of NEPA, build its structures before a case gets to court, and then hide behind the mootness doctrine. Such a result is not acceptable").
>
> Therefore, where an agency has failed to undertake the required NEPA analysis for prior decisions, it may not attempt to validate those prior decisions in a subsequent NEPA analysis that fails to remedy the earlier omission. See, e.g. *Pitt River Tribe v. United States Forest Serv*., 469 F.3d 768 (9th Cir. 2006)(held that where agencies never took the requisite "hard look" at whether the Medicine Lake Highlands should be developed for energy at all, and by the time the agencies completed an EIS, "the die already had been cast," the 1998 lease extensions and the proposed development of the invalid lease rights violated NEPA.) *Friends of Yosemite Valley v. Kempthorne,* 520 F. 3d 1024, 1037-1038 (9th Cir. 2008)(Court rejected the Park Service's decision to use components of a 2000 Comprehensive Management Plan that had previously been struck down by the court as the basis for its No Action alternative. The court held that the No Action alternative may not "assume the existence of the very plan being proposed.)
>
> Here, the Air Force is assuming the existence of a Snowbird Program that permits year-round flying of aircraft other than A-10s. But there is no NEPA-compliant agency decision underpinning these activities. Rather, they are taking place with gross disregard for NEPA's requirement that all federal actions undergo prior environmental review. Because there is no current NEPA-compliant decision authorizing overflights by aircraft other than A-10s, the No Action alternative in the current EA has been improperly defined. The only NEPA-compliant OSB program is the one that was in existence in 1978. That, not the program as it existed—in violation of NEPA—in 2009, should be used as the No Action alternative. The citizens of

> Tucson were, and remain, entitled to have the decision to expand the OSB program from a winter only program limited to A-10 aircraft to a year round program involving louder and more dangerous aircraft fully evaluated as NEPA requires.

Comment Letter I at 18-19 (emphasis added).

We continue to believe that the argument laid out above is valid and that the program as it existed in 1978 is an appropriate "no action" alternative. The Air Force's argument that its analysis in 1978 was "immature and insufficient" (p. 2-5) is hardly a defense to not evaluating the change in flying profiles at this point. However, we do wish to suggest an alternative approach. The Air Force could follow the standard practice of analyzing the current TFT program as the "no action alternative." This is consistent with CEQ's direction on characterization of the no action alternative in the face of ongoing actions:

> Section 1502.14(d) requires the alternatives analysis in the EIS to "include the alternative of no action." There are two distinct interpretations of "no action" that must be considered, depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.

Question 3, *Forty Most Asked Questions Concerning the Council on Environmental Quality's National Environmental Policy Act Regulations*, 46 Fed. Reg. 18026 (March 23, 1981, as amended; available at http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf (last accessed 11-12-2014).

The Air Force would still be responsible for evaluating the impacts of the program from 1978 to the present in so far as it is able to identify and analyze cumulative effects of these past actions. This is particularly important here because, as noted elsewhere, not only has the Air Force failed to comply with NEPA since 1978 with regard to the OSB program, it has never completed a NEPA analysis on the other programs included in the Revised EA. Moreover, because the FONSI is based only upon the incremental change in impacts since 2009 rather than the full range of environmental impacts foisted on the affected community without any NEPA analysis since 1978, it dramatically understates the true impact that the TFT activities have had and continue to have on the Tucson population living and working in the DM flight pattern.

The Air Force argues that 2009 is a better "no action" alternative because it is "similar to the average number of annual sorties flown between 2002 and now." But there is nothing in applicable law or guidance regarding the "no action" alternative that suggests that an agency can take average activity over a twelve year period and call that the “no action alternative.” The preponderance of the guidance on point weighs in favor of using the flights being experienced now and perhaps over the past one or two years. Budget constraints, part of the rationale for the decrease in flights in the past few years, may well continue into the foreseeable future; other factors, especially those dealing with responses to unrest in other parts of the world, are hard to predict. What is known is what is happening now, even if it was not the decision made originally. *See Seattle Audubon Society v. Lyons*, 871 F. Supp. 129, W.D. Wash. 1994 (affirmed that the current management was the correct “no action” alternative even though it was different from the alternative chosen in the existing management plan, which had been held invalid by a court).

What is apparent, however, is that the analysis of the “no action” alternative under either scenario - 1978 or the present - deserves full analytical treatment in the EA. The “no action” alternative in this revised EA suffers from the same deficiencies as the original EA in that the analysis presented is superficial and conclusory, entirely omits an analysis of health issues, suffers from major gaps in the noise analysis and virtually ignores any analysis of cumulative effects (as opposed to words on a page titled “cumulative impacts.” These failures begin with the failure to adequately evaluate a “no action” alternative. *Pitt River Tribe,* 469 F.3d at 768.

- **The EA Responds Inadequately to the Impacts of Dropping Ordnance**

In response to the comment in Comment Letter I that the original EA failed to address the impacts of ordnance, the Revised EA notes that NEPA documents do exist for the ranges where ordnance would fall. However, absolutely no citations are provided to those documents. Nor does the Revised EA indicate that those NEPA documents address the future impacts of TFT’s proposed jump from baseline conditions to the conditions that would exist under the Preferred Alternative, which seems unlikely. Clearly, the release of ordnance from planes leaving DM AFB is a closely connected action, which is triggered by the flight of planes from DM AFB and which is an interdependent part of a larger action. The Air Force should provide citations and links to the documents to which it refers.

- **The Revisions to the Economic Analysis Fail to Address the Potential Adverse Impact that Increased Flights Could Have on the Central City.**

Although the Revised EA purports to revise the economic analysis, it appears that the only substantive change is including more recent information regarding property valuations. It does not address the methodology problems we identified in Comment Letter I. Nor does it correct the most glaring error—relying solely upon past changes in property values as some sort of justification for its assertion that increased flights by louder planes will have a “negligible” effect on property values and tourism in the central city. This dismissive response insults those of us who live in midtown, for whom the effects of aircraft noise on property values is a significant concern. It also fails to address the potential economic impact of inverse condemnation claims or similar litigation that may be brought by residents who experience a decline in value to their properties. *See* *http://www.kaplankirsch.com/files/Airport_Noise_Litigation_in_the_21st_Century_As_Published.pdf*

If the Air Force were truly interested in evaluating the impact that increased flights may have on property values, it would begin by conducting a meaningful analysis of property values closest to DM from 1978 to the present, which includes the year-over-year changes in property values as correlated with the year-over-year changes in aircraft noise levels and the year-over-year changes in property values of other areas of Tucson. That would capture the impact that the expansion of the OSB program from a winter time program to a year round TFT has had on property values for those homes that have borne the brunt of that expansion, and could be used to extrapolate what a further increase in flights will have in the future. NEPA requires an analysis of reasonably foreseeable impacts, which by necessity requires the analysis to be forward-looking.

An analysis of hedonic property values is also warranted. See "Meta-Analysis of Airport Noise and Hedonic Property Values (Nelson, 2004). Every one of twenty hedonic studies confirms that property values decrease with aircraft noise. Even the FAA states bluntly, "Studies have shown that aircraft noise does decrease the value of the residential property located around airports." CITE

In sum, the dismissive attitude toward the concerns of residents regarding the value of their home—usually their most valuable asset—is both contrary to the requirements of NEPA and, frankly, discredits the Air Force.

- **Conclusion.**

In conclusion, we continue to believe that the environmental assessment conducted by the Air Force for OSB and now TFT fails to adequately address the full impact of the proposed action, and understates the significance of impacts that those programs have had and will continue to have on nearby residents. For the reasons explained above and in Comment Letter I, we believe that a full EIS is warranted; however, at a minimum, the Air Force should further revise the EA to address each of the inadequacies identified above.

Sincerely,

Americans for Livable Communities

By: ______________________________
Rita B. Ornelas

Arizona Center for Law in the Public Interest

By: ______________________________
Joy E. Herr-Cardillo

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 4:41 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: TFT EA COMMENT SUBMITTAL

From: Loisanne Keller [mailto:loisannek@gmail.com]
Sent: Monday, November 24, 2014 1:53 PM
To: 355 FW/PA Comments
Subject: TFT EA COMMENT SUBMITTAL

The recent DEA Finding Of No Significant Impact clearly does not reflect what is occurring in the Tucson basin.

You should have been in my house right now, which is about 10 miles from DMAFB and TIA and supposedly 'not in the flight path' of the jets taking off from the air base or the ANG from TIA. Conversation had to stop due to the noise. I can only imagine how it is for families, individuals, students, businesses who are in the direct flight path.

To claim there is not significant impact on the citizens of Tucson is a fallacy.

Any environmental impact study done must include all flights of DMAFB and ANG, current flights and proposed increases, current jets and the F16s the Iraqis will be training in over our basin. Your noise evaluations must include individual flights, not the sounds averaged over a 24 hour period.

Your decisions will impact hundreds of thousands of people (oh hey! is that a jet I hear right now over my 'not in the flight path' home?) in our Tucson basin. Be certain that your environmental impact information gathered is accurate, not skewed to make the AF look good.

There is plenty of desert open space not around a large metropolitan area where your AF/ANG needs for flight training could be met. And, whatever you do, keep the F35s away from Tucson and my home.
Sincerely,

Loisanne
Keller
Foothills of Tucson

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:47 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: TFT EA Public Comment, City of Tucson Comment Response
Attachments: 11-24-14 DMAFB.pdf

-----Original Message-----
From: Carolyn Laurie [mailto:Carolyn.Laurie@tucsonaz.gov]
Sent: Monday, November 24, 2014 5:21 PM
To: 355 FW/PA Comments
Cc: Chuck.Huckelberry@pima.gov; Albert Elias; Ernie Duarte; Kelly Gottschalk; Martha Durkin
Subject: TFT EA Public Comment, City of Tucson Comment Response

Mr. Dryden, P.E.

Please find attached the City of Tucson's response associated with the initial Draft Total Force Training Environmental Assessment.

Thank you for the opportunity for the City to comment during this public process.

Sincerely,

____

Carolyn Laurie
Code Administration
Planning & Development Services
City of Tucson
Carolyn.Laurie@tucsonaz.gov
520.837.4953

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Monday, November 24, 2014 4:22 PM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: TFT EA Public Comment
Attachments: Revised EA Comment Letter FINAL with Exhibit 1 for electronic submission.pdf; Comment Letter Exhibit 2 (WHO study).pdf

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From: Joy Herr-Cardillo [mailto:jherrcardillo@aclpi.org]
Sent: Monday, November 24, 2014 2:04 PM
To: 355 FW/PA Comments
Subject: TFT EA Public Comment

Attached is the Comment Letter from Americans for Livable Neighborhoods and the Center for Law in the Public Interest. This electronic submission differs slightly from the hard copy that I mailed earlier because the WHO study is a locked PDF file and although only excerpts were attached as Exhibit 2 to the hard copy, I could not delete any pages from the electronic version. I also had to keep the WHO study as a separate document. I tried scanning the exceroted pages, but ironically that electronic file turned out to be too large to send via email. Joy Herr-Cardillo

Joy E. Herr-Cardillo
Staff Attorney
ARIZONA CENTER FOR LAW IN THE PUBLIC INTEREST

Americans for Livable Communities
1517 N. Wilmot Rd. #116
Tucson, AZ 85712

Arizona Center for Law
in the Public Interest
2205 E. Speedway Blvd.
Tucson, AZ 85719
jherrcardillo@aclpi.org

November 24, 2014

Via electronic mail and first class mail
ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S Fifth Street
Davis-Monthan AFB, Arizona 85707

Re: Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona

To Whom it May Concern:

This letter represents the response to the solicitation of comments on the draft Environmental Assessment for the Update and Implementation of the Total Force Training ("TFT") Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona ("Revised EA") from Americans for Livable Communities ("ALC") and the Arizona Center for Law in the Public Interest ("Center").

ALC is an alliance of concerned citizens whose mission is to protect and enhance the livability, safety, property values, and economic viability of our communities. The communities we represent include homeowners who live and work in the flight pattern from Davis-Monthan Air Force base and would be affected in a number of ways if the proposed expansion of the TFT program is implemented. Several of the current members of ALC have also been active in Tucson Forward, a non-profit organization that was formed several years ago to protect Tucson and its neighborhoods from health damaging noise and safety concerns related to overflights from Davis-Monthan.

The Center is a nonprofit law firm dedicated to ensuring government accountability and protecting the legal rights of Arizonans. It frequently works with community groups that are concerned about the environmental impacts of proposed government projects or actions, and assists them in navigating the NEPA process.

In reviewing the Revised EA, it is important to consider it in context. Operation Snowbird ("OSB") began in 1975 as a way to train Air National Guard pilots based in northern states during the winter months. Over the years, the program evolved into year-round training; however, the last

NEPA analysis of the program was performed in 1978, before it expanded its schedule. Thus the environmental impacts of extending the program year round were never evaluated before the change was made. Nor were other significant changes to the program, such as the number and type of aircraft flown by participants, evaluated prior to their implementation. Consequently, in 2010, in response to questions raised by members of the public regarding the lack of the required NEPA analysis, the Air Force initiated an updated NEPA analysis. In July 2012, the Air Force released for public comment its Draft Environmental Assessment for the Proposed Update and Implementation of the National Guard Bureau Training Plan 60-1 in Support of Operation Snowbird Davis-Monthan Air Force Base, Arizona ("original EA"). The public comment period for the original EA closed in October 2012. The Center, along with a citizen-based organization, Tucson Forward, submitted extensive comments on the original EA ("Comment Letter I"). In their capacity as members of Tucson Forward, several members of ALC contributed to or were otherwise involved in the drafting of Comment Letter I. After the close of the comment period, the Air Force announced that it was revising the EA, purportedly to respond to the concerns expressed during the public comment period.[1] It took the Air Force nearly two years to revise the EA.

Unfortunately, after reviewing the Revised EA both the Center and ALC have concluded that the EA continues to be incomplete and inadequate and fails, utterly, to support the Finding of No Significant Impact ("FONSI"). For the reasons set forth below, we urge the Air Force to rescind the FONSI and prepare a full Environmental Impact Statement, as the law requires, or, at minimum a revised EA.

I. Introduction/General Overview of Law:

The National Environmental Policy Act ("NEPA") has "'twin aims. First, it places upon [a federal] agency the obligation to consider every significant aspect of the environmental impact of a proposed action. Second, it ensures that the agency will inform the public that it has indeed considered environmental concerns in its decisionmaking process.'" *Kern Bureau of Land Mgmt.,* 284 F.3d 1062, 1066 (9th Cir. 2002)(quoting *Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc.,* 462 U.S. 87, 97 (1983)). NEPA is not substantive. It does not require that agencies adopt the most environmentally friendly course of action. *Kern,* 284 F.3d at 1066. Rather, "[t]he sweeping policy goals . . . of NEPA are . . . realized through a set of 'action-forcing' procedures that require that agencies take a 'hard look at environmental consequences.'" *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332, 350 (1989)(quoting *Kleppe v. Sierra Club,* 427 U.S. 390, 410 n.20 (1976)).

In this case, the Air Force has failed to meet either goal. As discussed more fully below, the environmental analysis undertaken by the Air Force in the Revised EA grossly understates the impacts of the proposed action by, according to the Department of Defense's own policies, failing to fully and fairly evaluate the noise impacts on the quality of life and health of Tucson citizens who live within the flight path used by TFT. Second, instead of informing the public that the Air Force has, indeed, considered the environmental impact of its decision making, the Revised EA only confirms that the

[1] To the extent that issues we raised in Comment Letter I have not been addressed in the revised EA, we incorporate by reference the previous comment letter. Because it is already a part of the administrative record, we have not included a copy of the letter here.

agency has instead sought to mislead the public about how extensive the impacts may, in fact, be. NEPA requires more—substantially more.

II. The Discussion of Noise Impacts on the Affected Community Remains Inadequate Because it is Fundamentally Incomplete in Several Important Ways.

Agencies are obligated under NEPA to insure the professional integrity, including scientific integrity, of the discussions and analyses in their documentation. 40 C.F.R. §1502.24. The Air Force has fallen short of this requirement in several respects in regards to the important issue of noise impacts.

1. The assumptions underlying the day-night average sound level (DNL) have a very high likelihood of changing, thus significantly affecting the DNL projections and potentially changing the EA's analysis and the conclusions of the draft finding of no significant impact.

The draft noise analysis report is the basis for the EA's DNL contours and all other results of noise analysis. Sec. 2.1 of Appendix C lists five stages of noise analysis for this EA. To date, the first three stages are complete, and part of stage 4 is complete. Stage 5 has not begun. The Draft EA was released before the noise analysis was complete.

Further, according to Sec. 2.1, 2.2, and Table 2-1 of Appendix C, the report is based on seven assumptions. Now that the Draft EA has been released, DMAFB and ACC will review the seven assumptions. The review may change some or all of them. If any assumption changes, the noise analysis report will change which, in turn, could affect the EA, potentially in important ways. Table 2-1 of Appendix C assesses the likelihood that each assumption will change after DMAFB and ACC review it. In addition, the table assesses the impact that an altered assumption will have on the report and hence, on the EA. For example, the likelihood that Assumption 1 will change is high. And if Assumption 1 changes, its impact on the report and importantly, on the analysis in the EA, will be high.

The discussion in this section about these assumptions notes that they were made to enable noise modeling within the agreed-upon timelines. In fact, this analysis is already many years' late. The Air Force should complete the final report and revise the underlying analysis in the EA and recirculate it to the public for review and comment as either a supplement to the EA or as part of a draft EIS.

2. The DNL projections are not supplemented with other metrics, per applicable DOD guidance.

The Revised EA uses only one method to analyze the impacts of annoyance to the community from noise: DNL. The EA justifies this on its page 3-4: "DNL is the community noise metric recommended by the USEPA and has been adopted by most Federal agencies (USEPA 1974)." This USEPA recommendation is forty years old, and while we understand that DNL analysis is still commonly used, acoustics experts, most importantly within the Department of Defense, have recognized during the past four decades that DNL analysis tells only part of the story. For environments affected by short-duration, high-SEL events such as aircraft noise, DNL analysis fails to describe the most serious impacts. The only use of any other metric found in the EA is in Table 3-1 which presents "Representative SEL for Typical Aircraft under Flight Track at Various Altitudes," but this is in the affected environment section and SEL analysis is never presented in the impacts analysis.

In a 2009 publication, DOD forthrightly recognized the shortcomings of correlating DNL and the FICON Curve (updated from the Shultz Curve) for predicting community annoyance. C*ommunity Annoyance Caused by Noise From Military Aircraft Operations* (Department of Defense, December, 2009) (available at http://www.denix.osd.mil/dnwg/upload/Master-ANNOYANCE-12-09.pdf), Issues identified regarding DNL and the FICON Curve include "methodological questions, errors in measurement of both noise exposure and reported annoyance, data interpretation differences, and the problem of community response bias . . .[and] an extraordinary amount of scatter in the data." *Id.* at 5.

In recognition of the limitations of DNL and the FICON Curve as a useful methodology for prediction, DOD published a guide to using supplemental metrics, "to guide the Military Services in providing more useful information on the noise environment than is available through solely using the long-term cumulative metrics such as DNL." *Improving Aviation Noise Planning, Analysis and Public Communication with Supplemental Metrics* (December, 2009) at 1-1.(emphasis added)(hereinafter "*Supplemental Metrics*")(available at http://www.denix.osd.mil/dnwg/upload/DNWG_Supplemental-Metrics-Report_December-2009.pdf).

As stated in *Supplemental Metrics*:

> When using DNL to communicate noise exposure to the average citizen residing near a military airfield, a typical response is, "I don't hear averages, I hear individual airplanes." Airport neighbors often become angry and frustrated trying to understand explanations of noise exposure solely in terms of average sound energy with the DNL metric, particularly when they are trying to grasp the impact of . . . increased operations and aircraft changes.

Id. at 2-1. While the guide is clear that DOD is not replacing DNL, it provides considerable rationale for supplementing DNL with several other methodological approaches that are intended to provide more useful information on the noise environment than is available through solely using the long-term, cumulative metrics such as DNL. Importantly, the need for supplemental noise metrics is characterized as being two-fold: "(1) to produce more detailed noise exposure information for the decision process; and (2) to improve communication with the public about noise exposure from military activities." *Id.* at 1-1. DOD's articulation of need for supplemental metrics mirrors perfectly the purposes of the NEPA process.

Along with *Supplemental Metrics*, DOD also published a Technical Bulletin on *Using Supplemental Noise Metrics and Analysis Tools* (December, 2009)(available at http://www.denix.osd.mil/dnwg/upload/Master-Using-Supplemental-Metrics-12-09.pdf). The Bulletin provides detailed guidelines for the analysis and presentation of

- Maximum A-Weighted Sound Levels (Lmax)
- Sound Exposure Level (SEL)

- Equivalent Sound Level
- Time Above a Specified Sound Level (TA)
- Number-of-Events Above a Specified Sound Level (NA)

Id. at 7; *See also Supplemental Metrics* at 5-4 through 5-7. Guidelines on how to use these supplemental metrics are published in Table 6-1. *Supplemental Metrics.* at 6-3. While DNL is still characterized as the best metric for long-term annoyance, DOD warns that, "**it is inadvisable to use the average annoyance curve [Schultz/FICON] to predict the specific number or percentage of the local exposed population who are expected to be highly annoyed by aircraft operations at a given DNL**." *Id.* (emphasis in original). The Revised EA does contain what it characterizes as "representative SEL" for some aircraft to be used at DM, EA at 3-5, but this generic listing of SEL levels is hardly an analysis of SEL impacts of the TFT aircraft, and even omits many of the planes expected to be flying under the auspices of the TFT.

As DOD explains in *Supplemental Metrics*:

> While the Federal agencies have accepted DNL as the best metric for land use compatibility guidelines, reducing the description of noise exposure to a single value of DNL may not help the public understand noise exposure. Simply looking at the location of their home on a DNL contour map does not answer the important questions: how many times airplanes fly over, what time of day, what type of airplanes, or how these flights may interfere with activities, such as sleep and watching television. The number and intensity of the individual noise events that make up DNL are critically important to public understanding of the effects of noise around airports. What is needed is a better way to communicate noise exposure in terms that are more easily understood. Supplementing DNL with additional metrics will help the public better understand noise exposure.

Supplemental Metrics at p. 2-1.

In *Supplemental Metrics* the DOD recommends that results of the above metrics be presented in tables and/or as contour lines on maps (just as the TFT EA presents DNL contour lines) *Id.* at 5-10. The publication includes several real-life examples of both. The contour maps are particularly striking. At a glance, they provide very important information that is totally absent from DNL metrics. For example, at Marine Corps Air Station Cherry Point in North Carolina, the contour line for NA above 90 dB SEL extends eight and a half miles beyond the DNL 65 dB contour line. *See Id.*, Figure B-6 at p. B-16. This is crucial information. As *Supplemental Metrics* explains, the above metrics "are as important to the project stakeholders as they are to communicating with the general public, because they enable the project managers and decision makers to make better-informed decisions." *Id.* at 5-1.

Further, in relationship to the ongoing program at DM, residents have noted ongoing incidents in which aircraft from DM are flying outside of the flight paths presented in the EA. Indeed, Air Force representatives have stated that the pilots are allowed to fly anywhere in the Tucson. For example, in a response to a citzen's complaint about the noise from overhead aircraft, DM Public Affairs Officer, Sarah R. Ruckriegle, 1st Lt. wrote:

> Our pilots operate in dynamic airspace with a myriad of constantly changing factors that will affect their actual ground track. While they follow patterns that are reflected in graphics, which have been provided to the public by the base, there are no airspace restrictions, regulations, agreements or other mandates that restrict our pilots to specific ground tracks or street intersections. The graphics we have provided are intended to be tools to help residents and other interested parties become familiar with our most common traffic flow and the approximate vicinities where they will most commonly see our aircraft.

Letter dated July 29, 2013, attached as Exhibit 1.

Because the impacts to area residents and businesses are not fully represented by the DNL metric, and the affected area is potentially greater than the DNL contour identified in the Revised EA, at least some of these supplemental metrics should not only be considered but should be calculated and analyzed with NOISEMAP. Because the TFT EA uses NOISEMAP for its DNL metric, the inputs for these additional metrics may already be complete. Speech interference and classroom speech interference would seem particularly relevant. This analysis needs to be provided for public review and comment in a revised EA or draft EIS.

It is worth noting that failure to include these metrics can lead to litigation. *Supplemental Metrics* describes one successful lawsuit:

> The City of Oakland CA prepared the required Environmental Impact Report (EIR) to analyze the consequences of their proposed Airport Development Plan for the Metropolitan Oakland International Airport. Its adequacy in defining nighttime noise impacts solely with the DNL noise metric was challenged in court by a citizens group and in its decision, the California appeals court set a precedent (at least in California) that DNL 65 dB is not a sufficient criteria to use in Environmental Impact Reports for this purpose and that single event noise levels must also be considered.

Supplemental Metrics at C-12. To avoid a similar challenge here, the Air Force should consider which recommended metrics in *Supplemental Metrics* are most appropriate for the proposed TFT program, utilize them, and present the results in a revised EA or draft EIS.

3. <u>The EA uses the original Schultz Curve instead of the updated version recommended by DOD.</u>

For some unexplained reason, the Air Force chose to use the original Schultz curve in its analysis of public annoyance from noise exposure (Figure 3-1). As stated in *Supplemental Metrics*, the original 1978 Schultz curve has been updated, and the updated fit "is the current preferred form in the U.S." *Id.* at 3-3 and 3-5. While the differences between the original and updated version are characterized as not being "substantial," there are some differences and there is no explanation offered as to why the version currently accepted by both DOD and the Federal Interagency Committee on

Noise as being the preferred model was not utilized. Further, that the state of modeling annoyance curves has advanced beyond either the original or Shultz/FICON curve. Importantly, the Schultz curve has been substantially revised to differentiate among annoyance responses from different noise sources. Technical information regarding the update is provided in a separate comment letter from Mr. Gary A. Hunter, a professional civil engineer, dated November 24, 2014 and incorporated by reference.

In short, the use of a 34 year-old model to characterize annoyance to the community meets neither the standard necessary for professional integrity under NEPA nor the standards necessary to meet the Information Quality Act, Pub. L. 106–554, or the Department of Defense's guidelines under that Act:

> Components should not disseminate substantive information that does not meet a basic level of quality. An additional level of quality is warranted in those situations in involving influential scientific, financial, or statistical information. This additional level of quality for influential scientific, financial, or statistical analytical results requires that such information be "capable of being substantially reproduced.

Department of Defense Information Quality Guidelines, revised, 2007. The analysis should be revised using the most current, credible models available and presented for public review and comment in a revised EA or draft EIS.

4. <u>The EA fails to explain the omission of the Advanced Acoustic Model in the applicable NOISEMAP application.</u>

The Aircraft Noise Analysis proffered to support the TFT EA explains that the NOISEMAP suite of noise models includes three modules and states that only two of the modules were used for this analysis, (Appendix C, Noise Analysis, pp. 11-12). The Advanced Acoustic Model was omitted. There is no explanation of why this is the case, leaving the reader to guess at whether this third component has relevance to the TFT program at DM. A revised EA or draft EIS should explain this omission.

5. <u>NOISEMAP's reliability in terms of actual impacts is not assessed.</u>

Finally, the EA presents no information regarding NOISEMAP's actual reliability in terms of on-the-ground impacts. To our knowledge, no testing vis-a-vis actual operational data has taken place to compare actual impacts with NOISEMAP predictions. If such testing has taken place, whether at DM or elsewhere, the Air Force should include that information in a revised EA or a draft EIS.

6. <u>Increased noise impacts to residences in areas exposed to a DNL of between 70 and 74 DB are not discussed.</u>

The Revised EA neglects to analyze the increased noise impacts to the residents most affected by these flights. While the EA states that, "[a]reas exposed to a DNL above 65 dBA are generally not considered suitable for residential use," the contours show flights over residential areas in this zone.

(EA at 3-4, Figure 3-2). Yet the EA offers no analysis about the impact of the increase of flights over these residences. This is another example of where the supplemental metrics are critical to accurately evaluate the full impact. Even if there is no change in DNL metrics, an increase in NA metrics would have a tremendous adverse impact on quality of life that is already compromised. The "hard look" required by NEPA includes just this type of analysis.

The revised EA also still fails to identify appropriate mitigation measures as noted in Comment Letter I. The 70 dB zone is an area which particularly commands attention in terms of mitigation. The Air Force has totally failed to identify and analyze mitigation measures. While adoption of mitigation measures is not a requirement of the law, identification and analysis of such measures is part of the required analysis.

III. The Public Process for the Revised EA was Inadequate

The Air Force's process for public involvement in the Revised EA has been flawed from two perspectives. First, as discussed in detail in the section on noise impacts above and in several sections below, critical analysis has either not been completed or has not been shared with the public. This lack of disclosure inhibits a competent critique of the analysis underlying the Air Force's conclusion regarding the type of impacts which is of the widest concern to the public. We pointed this out in Comment Letter I, stating that, "the public has, as of this date, been unable to obtain the complete noise analysis upon which this EA is based. The Noise Data Collection Review and Validation Study (ACC 2007) referenced in the draft EA . . . . as the '2007 Noise Study' is only a collection of aircraft operations data needed to input a noise prediction model. Missing are the resulting NOISEMAP profiles. It is not possible to comprehensively and accurately comment on the noise analysis when documents cited in the draft EA are mislabeled and incomplete and not available on a timely basis to the public." Comment Letter I at 19.

The same type of omissions are associated with the Revised EA and present a formidable barrier to competent assessment on the part of the public and outside experts. Further, no explanation is given as to the omission of the availability of documentation or the failure to finalize the draft noise analysis report prior to the release of the revised EA. Thus, the public is left without the underlying data and analysis to provide an independent analysis but with the knowledge that, for example, the "risk profile" of the assumption for flight operations other than Visiting Units is very high and that a number of other critical assumptions have a medium to high likelihood of changing when the analysis is finalized (see Table 2.1-List of Assumptions).

Second, the Air Force seemingly forgot the lesson one would have thought it had learned from the original EA when it first ignored the largely Spanish-speaking neighborhood closest to Davis Monthan AFB. One of the rationales for an extension of the comment period on the original EA was the Air Force's late translation of the Revised EA's executive summary into Spanish. Yet, oddly, the Air Force neglected to provide a translation of this EA's executive summary and only provided a translated copy of the draft FONSI. Further, the Air Force has not reached out in any other way to residents of the Julia Keene neighborhood. The residents with known interest in this issue never received a postcard or a letter informing them of the availability of the revised EA, nor a copy of the EA in either English or Spanish. Indeed, it is telling that in the Revised EA, the Air Force gives itself credit for sending notices to disproportionately affected neighborhoods regarding the public scoping meetings and the release of the original EA, but not for the Revised EA. (p. 4-18). The residents in these neighborhoods have not lost interest in actions that affect their health, safety and well being.

IV. The Analysis of Cumulative Effects Continues to Be Missing and/or Inadequate

In Comment Letter I on the original EA for the OSB program, we pointed out numerous deficiencies in the cumulative impacts analysis for past, present and reasonably foreseeable future actions. We observed that the Air Force that it had "a particular burden in relationship to the past and present activities undertaken in OSB because the Air Force failed to comply with NEPA at the time significant operational and programmatic changes were made a number of years ago." Comment Letter I at 14. We also reminded the Air Force that, "the CEQ regulations do not just require the identification of actions having impacts on the same resources; they require analysis of those impacts" and noted that the EA did not provide such analysis.[2] Comment Letter I at 14. We stated that, "the Air Force needs to substantially rework the cumulative effects analysis" and that when done appropriately, we believed the analysis would, in fact, trigger a determination of significance, thus requiring preparation of an EIS. *Id.* Whether that is the case remains unknown, of course, because the Air Force has failed to publish an adequate analysis of cumulative effects.

In regards to cumulative impacts of past actions, the Air Force implies, in the Revised EA, that commentators are seeking analysis of aircraft that are no longer flying, (p. 2-5). That is not correct. What we actually stated and still stand by is that the Air Force must analyze OSB activities from 1978 through the present in two ways: i) to the extent that aircraft flying now were not being utilized in the OSB program as of 1978, that analysis must now be provided as part of the cumulative effects of past actions, as appropriate and present actions; ii) to the extent that aircraft not flying now were, at some point between 1978 and the present utilized in the OSB program, the Air Force should determine whether those the impacts of those aircraft are the same or very similar to aircraft now being proposed to be added to the OSB program, and if so, determine whether analysis of those impacts would be a useful addition to the analysis for the decision maker and the public.[3]

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[2] Federal courts have made it clear that a mere cataloguing of actions does not equate to cumulative effects analysis. *Center for Biological Diversity v. National Highway Traffic Safety Administration*, 538 F.3d 1172 (9th Cir. 2008); *Muckleshoot Indian Tribe v. US Forest service*, 177 F.3d 800, 811 (1999). Further, these requirements apply to environmental assessments as well as EIS's. *Kern v. U.S. Bureau of Land Management*, 2824 F.3d 1062, 1077 (9th Cir. 2002).

[3] It is also important to recognize that unlike the original EA, which only addressed OSB, the Revised EA now includes OSB, Multiservice Operations and Foreign Military Operations. OSB was last analyzed under NEPA in 1978; however, the other two operations, though ongoing for some years, have never been subjected to the NEPA analysis that the law requires. Therefore, the analysis of those Operations should include an exhaustive analysis of their impacts since their commencement.

Unfortunately, in the Revised EA any analysis of cumulative effects related to present and reasonably future actions remains missing in action. The Revised EA continues to merely identify actions without providing the analysis of the synergistic effects of those actions combined with the TFT program. Indeed, with the very minor addition of the mention of air shows, the analysis is essentially unchanged from the original EA. Neither the reader nor the decision maker are any better informed about the cumulative effects of the flights covered under the TFT program, other daily flight operations, CBP and TIA flights, etc., than they were before reading the Revised EA. Indeed, in Section 5.2, "Cumulative Effects Analysis," the statement is made that overlaps of use of military airspace "has not resulted in cumulative impacts" (p. 5-4). This suggests that the writer may believe that cumulative effects related to noise only occur if there are several flights in the vicinity of the same airspace at the same time. To the contrary, noise intrusions, whatever the cause of origin, can have cumulative effects on human beings through exposure to single noise events over a period of time. As discussed in the next section, a credible assessment of the health effects of noise would shed light on the true nature of the cumulative effects of the TFT program in combination with other noise.

V. The Revised EA Inexplicably Continues to Ignore Health Impacts.

NEPA requires federal agencies to assess the potential impacts of their proposed actions. Federal courts are deferential to agencies' analyses in areas of their expertise provided that agencies insure professional integrity, including scientific integrity, of the discussion and analyses, even when there is scientific disagreement. Agencies are free to reject critical comments on their analysis so long as credible opposing views are identified and an agency explains why comments do not warrant further agency response, "citing the sources, authorities, or reasons which support the agency's position. . . ." 40 C.F.R. 1503.4; *see also*, *Committee for Nuclear Responsibility v. Seaborg*, 463 F.2d 783, 787 (D.C. Cir. 1971).

What an agency is not free to do is simply ignore an entire category of impacts with no explanation. In Comment Letter I, we addressed in some detail the Air Force's failure to address health impacts of the current and proposed flights under the OSB, now the TFT, program. Comment Letter I at 4-5. Broadly speaking, we identified two types of health impacts. First, we discussed the "considerable body of professional literature on the health impacts of noise," cited current work done on this issue and pointed to literature on the subject. Secondly, we raised our concerns regarding black carbon deposits found over homes within the flight pattern and epidemiological research linking ultrafine particles contained in jet fuel with adverse human health impacts. *Id.* at 5.

In regards to the health impacts of noise, four days after Comment Letter I was submitted, Harvard School of Public Health and Boston University School of public health released a study analyzing noise impacts from 89 airports in the United States and utilizing data for approximately six million study participants. Noise levels were estimated "at the centroid of each census block surrounding each of the 89 airports out to a minimum of 45 dB . . . ." The study "found a statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular diseases among older people living near airports. This relation remained after controlling for individual data, zip code level socioeconomic status and demographics, air pollution, and roadway proximity variables." Correia, Andrew W., Peters, Juenette L., Levy, Jonathan, Melly, Steven, Dominici, Francesca, "Residential Exposure to Aircraft Noise and Hospital Admissions for Cardiovascular Diseases: Multi-airport Retrospective Study", BMJ 2013; 347:f5561; available at http://www.bmj.com/content/347/bmj.f5561, (last accessed 10/27/14). A study of individuals living in the vicinity of Heathrow Airport in London reached similar conclusions at about the same time as the American study. Hansell, Anna, Blangiardo, Marta, Fortunato, Lea, Floud, Sarah, Kees de Hoogh, Frecht, Daniela, Ghosh, Rebecca, Laszlo, Helga, Pearson, Clare, Beale, Linda, Beevers, Sean, Gulliver, John, Best, Nicky, Richardson, Sylvia, Elliott, Paul, "Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study." BMJU 2013: 347:f5432, available at http://www.bmj.com/content/347/bmj.f5432 (last accessed 10/27/14).

The Revised EA does characterize "health issues relative to noise and stress" as one of the most frequently cited concerns in comments letters on the original EA. Indeed, of impact issues raised, it was the fourth most common of fifteen issues identified (see Table 1-1). Yet the response to this significant issue was stunningly underwhelming. In the table summarizing responses to comments, health impacts are lumped together with safety risks and never addressed separately (Table 1-2). In Table 2-8, summarizing impacts, health is not even listed, although impacts receiving less attention by the affected public are identified. There are four sentences regarding impacts of noise in the body of the Revised EA (p. 3-4), none of which are specific to impacts of TFT flights over Tucson, and one which is a general statement regarding Air Force noise policy.(p. 3-5). The only other mention of health at all in the EA is in an introductory clause leading to a discussion of safety, as in "Health and safety risks," but with no discussion of health effects. And indeed, health impacts are not even mentioned in the section on cumulative effects.

The Revised EA's response to the concerns about particulate matter is equally unsatisfactory. The only mention of this type of comment at all is in Table 1-2, summarizing responses, in which it is stated that, "DMAFB will take into consideration complaints about black particulate matter accumulating in home AC filters." The Air Force fails to explain how it will take these complaints into account, let alone discuss the nature and impacts of the particulate matter. And Comment Letter I did not refer to air conditioning filters, but rather illnesses potentially related to the particulates.

These paltry responses utterly fail to even acknowledge the substantive comments made regarding this issue, let alone to take the required "hard look" at the potential impacts. The Air Force needs to take this issue seriously and proffer an intelligent response. The Department of Defense long ago recognized that the health effects, both the physiological effects and psychological effects (excluding direct effects on hearing), were important issues in relationship to overflights and noise. While earlier reports noted that, for example, "'[t]he results of early studies conducted in the United States, primarily concentrating on cardiovascular response to noise, have been contradictory," DOD's *Supplemental Metrics,* discussed above, recognized some progress in understanding the health effects of noise and noted that more research was needed. *Supplemental Metrics,*pp. 3-14 - 3-16. The Air Force has an obligation under NEPA to keep itself informed of the latest research results, including, but not limited to the recent reports identified in this letter. 40 C.F.R. § 1502.22(a). "[G]eneral statements about possible effects and some risk do not constitute a hard look absent a justification regarding why more definitive information could not be provided." *League of Wilderness Defenders-Blue Mountains Biodiversity Project v. U.S. Forest Service*, 689 F.3d 1060 (9th Cir. 2012), citing *Or. Natural Res. Council Fund v. Brong*, 492 F.3d 1120, 1134 (9th Cir.2007) (internal quotation marks omitted).

VI. The Revised EA Still Does Not Adequately Address Impacts to Children.

In Comment Letter I, we pointed out the fact that the EA failed to include an assessment on children as required by Executive Order 13045 (Protection of Children). The EO requires an assessment of "heath risks and safety risks that may disproportionately affect children." Comment Letter at 3. The revised EA purports to address this comment but does so in a very cursory fashion. For example, Section 3.3.5 is entitled "Protection of Children" and references EO 13045, but the bulk of the paragraph simply discussed the EO requirements, and the reason it was issued. The sole "analysis" included in this section is the assertion that "Schools and day care centers in the region were investigated, and it was determined that no schools and one day care center licensed for up to 60 children are located with the current 65 dBA DNL contour." Revised EA Section 3.3.5, p. 3-23. This assessment, however, falls far short of what is required under EO 13045.

The impact of noise on the cognitive development of children has been recognized in the scientific literature. For example, a 2011 study by the World Health Organization addressed at length the adverse impact that airport noise in particular has on the cognitive development of children. *See* "Burden of disease from environmental noise: Quantification of healthy life years lost in Europe," pp. 45-53 (excerpts attached as Exhibit 2) ("WHO Study"). As EPA has advised in a 2012 memorandum regarding "Addressing Children's Health through Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act," NEPA documents, including environmental assessments, should consider the impact that noise can have on children's health and learning, especially when it occurs near homes, schools, and daycare centers. (available at http://www.epa.gov/compliance/resources/policies/nepa/NEPA-Children's-Health-Memo-August-2012.pdf, last accessed 11/4/2014). EPA advises that noise can impact children's learning and stresses that when evaluating military bases or training, agencies need to consider the impact that an increase in noise will upon residences, schools, or child care facilities. *Id.*

As we pointed out in Comment Letter I, there are several schools within the flight pattern of Davis-Monthan, and one of them, the Griffin Foundation Charter School (elementary and middle school) appears to be barely outside the 65 dB noise contour.[4] Griffin has an enrollment of approximately 400 students, and also includes a day care facility. Other nearby schools while not necessarily as close to the 65dL flight contour are nonetheless close enough to be impacted by the increased noise, a fact that would likely be established if a more comprehensive noise analysis that

[4] Notably, Griffin School is located in the very same shopping center that was the site of a 1967 crash of a Davis-Monthan jet. http://www.tucsonfirefoundation.com/wp-content/uploads/2012/07/1967-Food-Giant-Diaster.pdf

included the supplemental metrics recommended by DOD were undertken. As noted above, the analysis should include metrics that are specific to classroom noise. For schools (as for so much else), these supplemental metrics are far more important, useful, and revealing than the DNL metric.

Finally, the noise impacts upon children are not limited to noise experienced in the school or daycare setting. The impact on children living within the flight pattern must also be taken into account. Much of the noise contour extends over residential neighborhoods. According to the revised EA, up to 128 single family residences and 4 multifamily residences are within the 65dBA DNL contour alone. Children living in those residences will be adversely impacted by the noise and the Air Force has an obligation under NEPA and EO 13045 to undertake a meaningful evaluation of the nature and extent of those impacts. Nor is the impact limited to children within the 65dBA DNL contour. Impacts to health are experienced at lower levels as well. The WHO study found that levels as low as 30 dB could disturb sleep and result in documented health impacts. *See* WHO Study, Table 4.1 Nocturnal Noise. Because the revised EA fails to even address these potential health impacts on children living within the flight pattern, it fails to comply with EO 13045 and NEPA.

VII. The Public Safety Analysis Continues to be Inadequate.

Comment Letter I raised three issues with respect to the public safety analysis. First we objected to the fact that the safety analysis failed to fully evaluate all potential aircraft that may be participating in OSB. That remains true in the Revised EA. Even though the scope of the analysis has expanded to include programs in addition to OSB, and the Revised EA acknowledges that over the past seven years, 18 different aircraft have been used in TFT (see Revised EA, Table 2-1, p. 2-6), the public safety analysis only considers the risk factors of 8 aircraft. The Air Force offers no explanation for why it did not include all potential aircraft and, in fact, there is no legitimate reason not to. Moreover, although the Revised EA acknowledges the recent decision to beddown 72 F-35A aircraft at Luke Air Force Base, it fails to even consider let alone address the possible inclusion of the F-35A in the TFT operations, even though such participation is reasonably foreseeable.

The second concern raised in Comment Letter I was the narrow scope of the safety analysis. By limiting the analysis to Class A mishaps, the Air Force continues to understate the risk that the proposed action presents to the public. We continue to believe the safety analysis is inadequate and deliberately misleading.

Finally, the third concern was the failure on the part of the Air Force to acknowledge the risks presented by pilots unfamiliar with the Tucson airspace. In its response to comments, the Air Force appears to misunderstand or misconstrue our earlier comment. Our concern was not that the visiting pilots were not properly trained. Our comment, based on first-hand experience of a former air traffic controller, was that even experienced pilots have to adjust to the unique requirements of DM and Tucson geography. As Comment Letter I explained:

> However, what the EA fails to acknowledge is that over the years, the practical experience with OSB pilots has revealed that even after these local area briefings, there is an initial adjustment period at the beginning of each training week where pilot errors are much more prevalent. For example, an occasional error made by visiting

> pilots is the mistake to turn immediately after take off and not fly a straight-out course as required, often risking an in-air collision with another recently departed aircraft traveling on a parallel departure route off of TUS. Reynolds Decl. ¶10. Another repeated problem area are recoveries instructed to fly the Davis recovery, erroneously flying off the radials of DM tacan and not Tus Vortac. *Id* at ¶11. Also prevalent are aircraft descending earlier than instructed on this recovery. *Id.* at ¶12. These mistakes provide a greater potential for loss of separation particularly closer in to the Tucson airport where due to the already close proximity of the airports, strict adherence to procedures and instructions are needed. *Id.*at ¶13, Such collisions have, fortunately, been avoided in the past because of the vigilance of the Tracon air traffic controllers, but it is a recurring problem that will only be exacerbated by an expansion of the program. *Id.*at ¶14.

Comment Letter I at p. 10. Thus, because it misunderstood or misconstrued the original comment, the Revised EA fails to address this concern and the safety analysis remains inadequate in this regard as well.

All of these safety issues should be fully addressed in either a Revised EA or an EIS.

VIII. The Environmental Justice Analysis Also Remains Inadequate.

Comment Letter I addressed at length the inadequacies of the environmental justice analysis in the original EA. Our comments took issue with the Air Force's assertion that it had reached out to the affected communities. We pointed out that this assertion was demonstrably false, and that, in fact, the outreach had been minimal and untimely. Comment Letter I at pp. 11-12. The Revised EA does not correct this misstatement but rather simply repeats it. Revised EA at 4-18; 1-11. Moreover, there was no effort on the part of the Air Force to reach out to the affected communities in connection with the Revised EA. No fliers or post cards advising of the release of the Revised EA were directed to the Julia Keen neighborhood—the neighborhood most directly affected. Rather, the Air Force relied almost exclusively on internet notifications and the DM website, even though low income minority communities are less likely to have internet access. The only Spanish translation prepared in connection with the Revised EA is of the FONSI. That is simply insufficient to allow for meaningful participation by the residents that the Air Force admits are disproportionately affected by the proposed action.

The other problems identified in Comment Letter I, the lack of a surface noise analysis and failure to identify mitigation measures, remain unaddressed in the Revised EA. Thus, we reassert those objections and continue to contend that the environmental justice analysis is woefully inadequate.

IX. The Revised EA's Characterization of the "No Action" Alternative is Incorrect

Comment Letter I explained that:

> Federal regulations explicitly require that environmental review be timely. "Agencies shall integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts." 40 C.F.R. § 1501.2 (2005). Consistent with this requirement, the Ninth Circuit has repeatedly held that dilatory or ex post facto environmental review cannot cure an initial failure to undertake environmental review. *See, e.g. West v. Secretary of the Department of Transportation,* 206 F.3d 920, 925 (9th Cir. 2000) (holding that if completion of the challenged action were sufficient to moot a NEPA claim, an agency "could merely ignore the requirements of NEPA, build its structures before a case gets to court, and then hide behind the mootness doctrine. Such a result is not acceptable").
>
> Therefore, where an agency has failed to undertake the required NEPA analysis for prior decisions, it may not attempt to validate those prior decisions in a subsequent NEPA analysis that fails to remedy the earlier omission. See, e.g. *Pitt River Tribe v. United States Forest Serv*., 469 F.3d 768 (9^{th} Cir. 2006)(held that where agencies never took the requisite "hard look" at whether the Medicine Lake Highlands should be developed for energy at all, and by the time the agencies completed an EIS, "the die already had been cast," the 1998 lease extensions and the proposed development of the invalid lease rights violated NEPA.) *Friends of Yosemite Valley v. Kempthorne,* 520 F. 3d 1024, 1037-1038 (9th Cir. 2008)(Court rejected the Park Service's decision to use components of a 2000 Comprehensive Management Plan that had previously been struck down by the court as the basis for its No Action alternative. The court held that the No Action alternative may not "assume the existence of the very plan being proposed.)
>
> Here, the Air Force is assuming the existence of a Snowbird Program that permits year-round flying of aircraft other than A-10s. But there is no NEPA-compliant agency decision underpinning these activities. Rather, they are taking place with gross disregard for NEPA's requirement that all federal actions undergo prior environmental review. Because there is no current NEPA-compliant decision authorizing overflights by aircraft other than A-10s, the No Action alternative in the current EA has been improperly defined. The only NEPA-compliant OSB program is the one that was in existence in 1978. That, not the program as it existed—in violation of NEPA—in 2009, should be used as the No Action alternative. The citizens of Tucson were, and remain, entitled to have the decision to expand the OSB program from a winter only program limited to A-10 aircraft to a year round program involving louder and more dangerous aircraft fully evaluated as NEPA requires.

Comment Letter I at 18-19 (emphasis added).

We continue to believe that the argument laid out above is valid and that the program as it existed in 1978 is an appropriate "no action" alternative. The Air Force's argument that its analysis in 1978 was "immature and insufficient" (p. 2-5) is hardly a defense to not evaluating the change in flying profiles at this point. However, we do wish to suggest an alternative approach. The Air Force could follow the standard practice of analyzing the current TFT program as the "no action alternative." This is consistent with CEQ's direction on characterization of the no action alternative in the face of ongoing actions:

> Section 1502.14(d) requires the alternatives analysis in the EIS to "include the alternative of no action." There are two distinct interpretations of "no action" that must be considered, depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.

Question 3, *Forty Most Asked Questions Concerning the Council on Environmental Quality's National Environmental Policy Act Regulations*, 46 Fed. Reg. 18026 (March 23, 1981, as amended; available at http://energy.gov/sites/prod/files/G-CEQ-40Questions.pdf (last accessed 11-12-2014).

The Air Force would still be responsible for evaluating the impacts of the program from 1978 to the present in so far as it is able to identify and analyze cumulative effects of these past actions. This is particularly important here because, as noted elsewhere, not only has the Air Force failed to comply with NEPA since 1978 with regard to the OSB program, it has never completed a NEPA analysis on the other programs included in the Revised EA. Moreover, because the FONSI is based only upon the incremental change in impacts since 2009 rather than the full range of environmental impacts foisted on the affected community without any NEPA analysis since 1978, it dramatically understates the true impact that the TFT activities have had and continue to have on the Tucson population living and working in the DM flight pattern.

The Air Force argues that 2009 is a better "no action" alternative because it is "similar to the average number of annual sorties flown between 2002 and now." But there is nothing in applicable law or guidance regarding the "no action" alternative that suggests that an agency can take average activity over a twelve year period and call that the "no action alternative." The preponderance of the guidance on point weighs in favor of using the flights being experienced now and perhaps over the past one or two years. Budget constraints, part of the rationale for the decrease in flights in the past few years, may well continue into the foreseeable future; other factors, especially those dealing with responses to unrest in other parts of the world, are hard to predict. What is known is what is happening now, even if it was not the decision made originally. *See Seattle Audubon Society v. Lyons*, 871 F. Supp. 129, W.D. Wash. 1994 (affirmed that the current management was the correct "no action" alternative even though it was different from the alternative chosen in the existing management plan, which had been held invalid by a court).

What is apparent, however, is that the analysis of the "no action" alternative under either scenario - 1978 or the present - deserves full analytical treatment in the EA. The "no action" alternative in this revised EA suffers from the same deficiencies as the original EA in that the analysis presented is superficial and conclusory, entirely omits an analysis of health issues, suffers from major gaps in the noise analysis and virtually ignores any analysis of cumulative effects (as opposed to words on a page titled "cumulative impacts." These failures begin with the failure to adequately evaluate a "no action" alternative. *Pitt River Tribe,* 469 F.3d at 768.

X. The EA Responds Inadequately to the Impacts of Dropping Ordnance

In response to the comment in Comment Letter I that the original EA failed to address the impacts of ordnance, the Revised EA notes that NEPA documents do exist for the ranges where ordnance would fall. However, absolutely no citations are provided to those documents. Nor does the Revised EA indicate that those NEPA documents address the future impacts of TFT's proposed jump from baseline conditions to the conditions that would exist under the Preferred Alternative, which seems unlikely. Clearly, the release of ordnance from planes leaving DM AFB is a closely connected action, which is triggered by the flight of planes from DM AFB and which is an interdependent part of a larger action. The Air Force should provide citations and links to the documents to which it refers.

XI. The Revisions to the Economic Analysis Fail to Address the Potential Adverse Impact that Increased Flights Could Have on the Central City.

Although the Revised EA purports to revise the economic analysis, it appears that the only substantive change is including more recent information regarding property valuations. It does not address the methodology problems we identified in Comment Letter I. Nor does it correct the most glaring error—relying solely upon past changes in property values as some sort of justification for its assertion that increased flights by louder planes will have a "negligible" effect on property values and tourism in the central city. This dismissive response insults those of us who live in midtown, for whom the effects of aircraft noise on property values is a significant concern. It also fails to address the potential economic impact of inverse condemnation claims or similar litigation that may be brought by residents who experience a decline in value to their properties. *See http://www.kaplankirsch.com/files/Airport_Noise_Litigation_in_the_21st_Century_As_Published.pdf*

If the Air Force were truly interested in evaluating the impact that increased flights may have on property values, it would begin by conducting a meaningful analysis of property values closest to DM from 1978 to the present, which includes the year-over-year changes in property values as correlated with the year-over-year changes in aircraft noise levels and the year-over-year changes in property values of other areas of Tucson. That would capture the impact that the expansion of the OSB program from a winter time program to a year round TFT has had on property values for those homes that have borne the brunt of that expansion, and could be used to extrapolate what a further increase in flights will have in the future. NEPA requires an analysis of reasonably foreseeable impacts, which by necessity requires the analysis to be forward-looking.

An analysis of hedonic property values is also warranted. See "Meta-Analysis of Airport Noise and Hedonic Property Values (Nelson, 2004). Every one of twenty hedonic studies confirms that property values decrease with aircraft noise. Even the FAA states bluntly, "Studies have shown that aircraft noise does decrease the value of the residential property located around airports." Aviation Noise Effects, Subsection 15.1. (FAA, March 1985)

In sum, the dismissive attitude toward the concerns of residents regarding the value of their home—usually their most valuable asset—is both contrary to the requirements of NEPA and, frankly, discredits the Air Force.

XII. Conclusion.

In conclusion, we continue to believe that the environmental assessment conducted by the Air Force for OSB and now TFT fails to adequately address the full impact of the proposed action, and understates the significance of impacts that those programs have had and will continue to have on nearby residents. For the reasons explained above and in Comment Letter I, we believe that a full EIS is warranted; however, at a minimum, the Air Force should further revise the EA to address each of the inadequacies identified above.

Sincerely,

Americans for Livable Communities

By: Rita B. Ornelas
Rita B. Ornelas

and

By:
Anita Scales

Arizona Center for Law in the Public Interest

By:
Joy E. Herr-Cardillo

EXHIBIT 1

DEPARTMENT OF THE AIR FORCE
355TH FIGHTER WING (ACC)
DAVIS-MONTHAN AIR FORCE BASE ARIZONA

29 July 2013

First Lieutenant Sarah R. Ruckriegle
355th Fighter Wing Public Affairs
3406 South First Street
Davis-Monthan AFB AZ 85707

[redacted]

Dear [redacted]

In response to your numerous queries concerning the proximity of Davis-Monthan Air Force Base flight operations to your address allow me to confirm that your residence at [redacted] does in fact underlay the approach and departure corridors to the northwest of our runway. You also live below Class C terminal airspace, as designated by the Federal Aviation Administration to safely accommodate air traffic near medium density airfields. In Class C airspace all aircraft, including military aircraft, must establish two-way radio communications with the FAA's servicing air traffic control facility prior to entering the airspace, as well as maintain those communications while in the airspace. The Tucson Terminal Radar Approach Control (TRACON), which is responsible for ensuring the safe arrival and departure of all aircraft (military, commercial and civilian) in Tucson airspace, provides guidance to pilots on headings, altitudes and directions. Our aircraft follow the guidance and clearance of TRACON, in accordance with all FAA regulations, as well as all U.S. Air Force and Davis-Monthan Air Force Base operational procedures.

In 2012 we recorded 185 complaints from you via email, voice mail (PA Noise Complaint Hotline) or by direct phone contact with the Public Affairs staff. As of 25 Jul 2013 we have recorded 124 complaints received from you as either [redacted]

In researching this, we provided your complaints and questions to the Davis-Monthan Airfield Operations Board and they confirmed not only that your residence lies under the Davis-Monthan approach and departure corridors but it is very near the final approach course of the Air Force/FAA published instrument approach/departure procedures for Davis-Monthan AFB. Your residence is also a common location where our pilots, who have been cleared to land and are approaching from the northeast, will turn to make their final descent and approach into Davis-Monthan.

Our pilots operate in dynamic airspace with a myriad of constantly changing factors that will affect their actual ground track. While they follow patterns that are reflected in graphics, which have been provided to the public by the base, there are no airspace restrictions, regulations, agreements or other mandates that restrict our pilots to specific ground tracks or street intersections. The graphics we have provided are intended to be tools to help residents and other interested parties become familiar with our most common traffic flow and the approximate vicinities where they will most commonly see our aircraft.

We are proud to be part of the Tucson community. We are very aware though that our flight operations have an effect on City of Tucson residents. As such, we are constantly reviewing and refining our flight procedures to minimize our impact on the community. The insights, complaints and feedback we receive through the base's Noise Complaint program provide us with valuable public feedback and are sent to base operations personnel on a regular basis and briefed on a quarterly basis to airfield operations decision makers. We thank you for using the Noise Complaint Hotline 228-5091, which allows us to accurately capture your complaints and ensure they are all logged and forwarded appropriately.

Very Respectfully,

Sarah Ruckriegle

SARAH R. RUCKRIEGLE, 1st Lt
Public Affairs Officer

EXHIBIT 2

World Health Organization
REGIONAL OFFICE FOR Europe
JRC
EUROPEAN COMMISSION

Burden of disease from environmental noise

Quantification of healthy life years lost in Europe

Burden of disease from environmental noise

Quantification of healthy life years lost in Europe

World Health Organization

REGIONAL OFFICE FOR **Europe**

JRC

EUROPEAN COMMISSION

The WHO European Centre for Environment and Health, Bonn Office, WHO Regional Office for Europe coordinated the development of this publication.

KEYWORDS

NOISE – ADVERSE EFFECTS

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RISK ASSESSMENT

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EUROPE

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Edited by Frank Theakston, layout by Dagmar Bengs

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ABSTRACT

The health impacts of environmental noise are a growing concern among both the general public and policy-makers in Europe. This publication was prepared by experts in working groups convened by the WHO Regional Office for Europe to provide technical support to policy-makers and their advisers in the quantitative risk assessment of environmental noise, using evidence and data available in Europe. The chapters contain the summary of synthesized reviews of evidence on the relationship between environmental noise and specific health effects, including cardiovascular disease, cognitive impairment, sleep disturbance and tinnitus. A chapter on annoyance is also included. For each outcome, the environmental burden of disease methodology, based on exposure–response relationship, exposure distribution, background prevalence of disease and disability weights of the outcome, is applied to calculate the burden of disease in terms of disability-adjusted life-years (DALYs). With conservative assumptions applied to the calculation methods, it is estimated that DALYs lost from environmental noise are 61 000 years for ischaemic heart disease, 45 000 years for cognitive impairment of children, 903 000 years for sleep disturbance, 22 000 years for tinnitus and 587 000 years for annoyance in the European Union Member States and other western European countries. These results indicate that at least one million healthy life years are lost every year from traffic-related noise in the western part of Europe. Sleep disturbance and annoyance, mostly related to road traffic noise, comprise the main burden of environmental noise. Owing to a lack of exposure data in south-east Europe and the newly independent states, it was not possible to estimate the disease burden in the whole of the WHO European Region. The procedure of estimating burdens related to environmental noise exposure presented here can be used by international, national and local authorities as long as the assumptions, limitations and uncertainties reported in this publication are carefully taken into account.

LIST OF ACRONYMS AND ABBREVIATIONS

ADL	Activity of daily life
AF	Attributable fraction
AR	Attributable risk
CI	Confidence interval
CLAMES	Classification and Measurement System of Functional Health
DALY	Disability-adjusted life year
DEN	Day-evening-night equivalent level
DW	Disability weight
EBD	Environmental burden of disease
EEA	European Environment Agency
EEG	Electroencephalogram
EMG	Electromyogram
END	Environmental noise directive (2002/49/EC)
EOG	Electrooculogram
ETC LUSI	European Topic Centre on Land Use and Spatial Information
EU	European Union
EUR-A	WHO epidemiological subregion in Europe: Andorra, Austria, Belgium, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland and the United Kingdom
GBD	Global burden of disease
HA	Highly annoyed people
HSD	Highly sleep disturbed people
ICD-9	International Statistical Classification of Diseases and Related Health Problems, ninth revision
ICD-10	International Statistical Classification of Diseases and Related Health Problems, tenth revision
$L_{Aeq,th}$ or $L_{eq,th}$	A-weighted equivalent sound pressure level over t hours
L_{den}	Day-evening-night equivalent sound level
L_{dn}	Day-night equivalent sound level
L_{night}	Night equivalent sound level
NIHL	Noise-induced hearing loss
NOISE	Noise Observation and Information Service for Europe
NYHA	New York Heart Association
OR	Odds ratio
OSAS	Obstructive sleep apnea syndrome
PAR	Population attributable risk
PSG	Polysomnography
REM	Rapid eye movement
SWS	Slow wave sleep
WHO	World Health Organization
YLD	Years lost due to disability
YLL	Years of life lost

FOREWORD

Public health experts agree that environmental risks constitute 25% of the burden of disease. Widespread exposure to environmental noise from road, rail, airports and industrial sites contributes to this burden. One in three individuals is annoyed during the daytime and one in five has disturbed sleep at night because of traffic noise. Epidemiological evidence indicates that those chronically exposed to high levels of environmental noise have an increased risk of cardiovascular diseases such as myocardial infarction. Thus, noise pollution is considered not only an environmental nuisance but also a threat to public health.

In 1999, WHO summarized the scientific evidence on the harmful impacts of noise on health and made recommendations on guideline values to protect public health in its *Guidelines for community noise*. The European Union (EU) enacted a directive on the management of environmental noise in 2002 and, accordingly, most EU Member States have produced strategic noise maps and action plans on environmental noise. The WHO European Centre for Environment and Health, Bonn Office, with the financial support of the European Commission, developed *Night noise guidelines for Europe* and provided expertise and scientific advice to policy-makers for future legislation in the area of night noise control and surveillance. Furthermore, a series of projects addressing the health burden of noise was implemented by the WHO Regional Office for Europe in 2005–2009.

At the Fifth Ministerial Conference on Environment and Health, in Parma, Italy in March 2010, the Member States urged WHO to develop suitable guidelines on environmental noise policy. This publication, developed by WHO with the support of the Joint Research Centre of the European Commission, responds to that request by assisting policy-makers in quantifying the health impacts of environmental noise. The evidence-base on burden of disease presented here will inform the new European health policy, Health 2020, which is being prepared by the WHO Regional Office for Europe for endorsement by the Member States in 2012.

The review of the scientific evidence supporting exposure–response relationships and case studies in calculating burden of disease was performed by a working group composed of outstanding scientists. The contents of this publication have been peer reviewed. The Regional Office is thankful to those who contributed to its development and presentation of this document and believe that this work will facilitate the implementation of the Parma Declaration and contribute to improving the health of the citizens of Europe.

Dr Guénaël R. M. Rodier
Director, Division of Communicable Diseases, Health Security and Environment
WHO Regional Office for Europe

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Editors

Lin Fritschi

Western Australian Institute for Medical Research, University of Western Australia, Australia

A. Lex Brown

Urban Research Program, Griffith University, Australia

Rokho Kim

WHO Regional Office for Europe, European Centre for Environment and Health (Bonn), Germany

Dietrich Schwela

Stockholm Environment Institute, University of York, United Kingdom

Stelios Kephalopoulos

European Commission Joint Research Centre, Institute for Health & Consumer Protection, Italy

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Peer reviewers

Bernard F Berry (United Kingdom)

Tim Driscoll (Australia)

Gary Evans (USA)

William Hal Martin (USA)

Danny Houthuijs (The Netherlands)

Anne Knol (The Netherlands)

David Michaud (Canada)

Evy Öhrström (Sweden)

Annette Prüss-Üstün (WHO)

Michel Vallet (France)

Martin van den Berg (The Netherlands)

Irene van Kamp (The Netherlands)

G R Watts (United Kingdom)

Meeting participants and authors:

Wolfgang Babisch
Department of Environmental Hygiene
Division of Environment and Health
Federal Environment Agency (UBA)
Germany

Anna Bäckman
Implementation and Enforcement Department
Swedish Environment Protection Agency
Sweden

Mathias Basner
Unit for Experimental Psychiatry
Division of Sleep and Chronobiology
University of Pennsylvania School of Medicine
USA

Birgitta Berglund
Institute of Environmental Medicine
Karolinska Institute
Sweden

Bernard Berry
Berry Environmental Ltd
United Kingdom

Gösta Bluhm
Institute of Environmental Medicine
Karolinska Institute
Sweden

Hans Boegli
Department of Environment
Transport, Energy & Communications
Federal Office for the Environment (FOEN)
Switzerland

Elena Boldo
ISCIII–WHO Collaborating Centre for the Epidemiology of Environment Related Diseases
Spain

Xavier Bonnefoy (deceased)
WHO European Centre for Environment and Health (Bonn)
WHO Regional Office for Europe
Germany
(Project leader until 2006)

Dick Botteldooren
Ghent University
Belgium

A. Lex Brown
Urban Research Program
Griffith University
Australia

Thomas Classen
University of Bielefeld
School of Public Health
Germany

Charlotte Clark
Centre for Psychiatry
Barts and London School of Medicine
United Kingdom

Claudia Côté
Institut de réadaptation en déficience physique de Québec
Canada

Pierre Deshaies
Community Medicine
Centre hospitalier affilié universitaire
Hôtel-Dieu de Lévis
Institut national de santé publique du Québec and Direction de santé publique Chaudière-Appalaches
Canada

Franz-Josef Feldmann
Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Germany

Lawrence Finegold
Finegold & So Consultants
USA

Michiko So Finegold
Finegold & So Consultants
USA

Willem Franken
Head of Environmental Protection
Rulemaking Directorate
European Aviation Safety Agency
Germany

Lin Fritschi
Western Australian Institute for
Medical Research
University of Western Australia
Australia

Gabor Gereb
Sol Data SA
Hungary

Balazs Gergely
DG Environment
Unit C3 – Clean air and Transport
European Commission
Belgium

Serge-André Girard
Institut national de santé publique du
Québec
Canada

Truls Gjestland
SINTEF ICT
Norway

Zilma Gonzales
Institut national de santé publique
du Québec
Canada

Eberhard Greiser
Epi.Consult GmbH
Germany

Barbara Griefahn
Institute for Occupational Physiology
Technical University Dortmund
Germany

Colin Grimwood
Bureau Veritas
Acoustics & Vibration Group
United Kingdom

Rainer Guski
Fakultät für Psychologie
AG Umweltpsychologie
Ruhr-Universität Bochum
Germany

Edward Hawker
Natural Environment Economics
Team
Department for Environment, Food
and Rural Affairs (DEFRA)
United Kingdom

Sylvie Hébert
University of Montreal
Canada

Danny Houthujis
National Institute for Public Health
and the Environment (RIVM)
Netherlands

Ken Hume
School of Biology, Chemistry and
Health Science
Faculty of Science and Engineering
Manchester Metropolitan University
United Kingdom

Staffan Hygge
Environmental Psychology
University of Gävle
Sweden

Sabine A. Janssen
TNO Built Environment and
Geosciences Delft
Netherlands

Lars Järup (deceased)
Department of
Epidemiology and Public Health
Imperial College of Science,
Technology and Medicine
United Kingdom

Snezana Jovanovic
Regierungspräsidium Stuttgart
Gesundheitschutz für Arbeit und
Umwelt
Germany

Jenni Keel
Section Air Traffic, Military, Impacts
Federal Office for the Environment
Switzerland

Stelios Kephalopoulos
European Commission
Joint Research Centre
Institute for Health & Consumer
Protection
Italy

Rokho Kim
WHO European Centre for
Environment and Health (Bonn)
WHO Regional Office for Europe
Germany
(Project leader from 2007)

Ronny Klaeboe
Institute of Transport Economics
Norway

Anne Knol
National Institute for Public Health
and the Environment (RIVM)
Netherlands

Young Ah Ku
World Health Organization
Switzerland

Tony Leroux
University of Montreal
Canada

Christian Maschke
Forschungs- und Beratungsbüro
Maschke
Forschungsverbund Lärm und
Gesundheit
Germany

Bernadette McKell
Hamilton & McGregor
Acoustics Division
United Kingdom

Odile Mekel
NRW Institute of Health and Work
Germany

David Michaud
Department of Health
Canadian Federal Government
Canada

Henk M.E. Miedema
TNO Built Environment and
Geosciences
Netherlands

Jarlath Molloy
Department of Civil and
Environmental Engineering
Centre for Transport Studies
Imperial College London
United Kingdom

Nicole Normandin
University of Montreal
Canada

Ruedi Müller-Wenk
Universität St. Gallen
Switzerland

Colin Nugent
European Environment Agency
Denmark

Sirkka-Liisa Paikkala
Environmental Protection
Department
Ministry of the Environment
Finland

Louise Paré
Centre de réadaptation en déficience physique Le Bouclier
Canada

Stefan Plontke
University of Tübingen
Germany

Annette Prüss-Üstün
World Health Organization
Switzerland

Dragomira Raeva
Air, Noise and Nanotechnology
European Environmental Bureau
Belgium

Nina Renshaw
European Federation for Transport and Environment
Belgium

Gordana Ristovska
Republic Institute for Health Protection
The former Yugoslav Republic of Macedonia

Jurgita Saulyte
Noise Prevention Division
State Environmental Health Centre
Lithuania

Dietrich Schwela
Stockholm Environment Institute
University of York
United Kingdom

Stephen Stansfeld
Centre for Psychiatry
Wolfson Institute of Preventive Medicine
Barts and London School of Medicine and Dentistry
United Kingdom

Richard Tyler
University of Iowa
USA

Michel Vallet
Institut AEDIFICE
France

Irene Van Kamp
National Institute for Public Health and the Environment (RIVM)
Netherlands

Evi Vogel
Bayerisches Staatministerium für Umwelt, Gesundheit und Verbraucherschutz
Germany

Ilse M Zalaman
University of Tübingen
Germany

Hans-Peter Zenner
University of Tübingen
Germany

EXECUTIVE SUMMARY

Introduction

Urbanization, economic growth and motorized transport are some of the driving forces for environmental noise exposure and health effects. Environmental noise is defined as noise emitted from all sources except industrial workplaces. The EU Directive on the management of environmental noise (END) adds industrial sites as sources of environmental noise.

To estimate the environmental burden of disease (EBD) due to environmental noise, a quantitative risk assessment approach has to be used. Risk assessment refers to the identification of hazards, the assessment of population exposure and the determination of appropriate exposure–response relationships. The EBD is expressed as disability-adjusted life years (DALYs). DALYs are the sum of the potential years of life lost due to premature death and the equivalent years of "healthy" life lost by virtue of being in states of poor health or disability.

WHO estimated the global burden of disease (GBD) in the second half of the 1990s. The environmental burden of disease due to environmental factors such as lead, outdoor and indoor air pollution and water and sanitation was first published in 2002. The WHO European Centre for Environment and Health, Bonn Office, convened meetings of a working group to estimate the EBD due to exposure to environmental noise. The conclusions and recommendations of these meetings were synthesized to develop this guidance publication on risk assessment of environmental noise using evidence and data available in Europe.

The target audience for this publication is primarily policy-makers, their technical advisers and staff from supporting agencies, and other stakeholders who need to estimate the effects of environmental noise. It brings together evidence-based information on health effects of environmental noise and provides exemplary guidance on how to quantify these effects. In summary, the aims of the publication are to provide:

- guidance on the procedure for the health risk assessment of environmental noise;
- reviews of evidence on the relationship between environmental noise and health effects;
- exemplary estimates of the burden of the health impacts of environmental noise; and
- a discussion of the uncertainties and limitations of the EBD procedure.

The health end-points of environmental noise considered by the working group for the EBD estimation included cardiovascular disease, cognitive impairment, sleep disturbance, tinnitus and annoyance. Although annoyance was not addressed as a health outcome of the GBD project, it was selected for the EBD estimation in consideration of WHO's broad definition of health.

Exposure assessment

Assessment of exposure to noise requires consideration of many factors, including:

- the measured or calculated/predicted exposure, described in terms of an appropriate noise metric; and
- the distribution of the exposure of the population to noise.

Population noise exposure in this publication is based on the noise mapping mandated by the END, using the annual average metrics of L_{den} (day-evening-night equivalent level) and L_{night} (night equivalent level) proposed in the Directive.

$$L_{den} = 10 \cdot \lg \frac{1}{24}\left(12 \cdot 10^{\frac{L_{day}}{10}} + 4 \cdot 10^{\frac{L_{evening}+5}{10}} + 8 \cdot 10^{\frac{L_{night}+10}{10}}\right)$$

with $L_{day} = L_{eq,12h}$, $L_{evening} = L_{eq,4h}$

and $L_{night} = L_{eq,8h}$

with $L_{Aeq,th}$ the A-weighted equivalent sound pressure level over t hours outside at the most exposed facade.

Methods of environmental burden of disease assessment

The burden of disease is expressed in DALYs in the general population through the equation

DALY = YLL + YLD

In this equation, YLL is the number of "years of life lost" calculated by

$$YLL = \sum_i (N_i^m \cdot L_i^m + N_i^f \cdot L_i^f)$$

where $N_i^m (N_i^f)$ is the number of deaths of males (females) in age group i multiplied by the standard life expectancy $L_i^m (L_i^f)$ of males (females) at the age at which death occurs. YLD is the number of "years lived with disability" estimated by the equation

$$YLD = I \cdot DW \cdot D$$

where I is the number of incident cases multiplied by a disability weight (DW) and an average duration D of disability in years. DW is associated with each health condition and lies on a scale between 0 (indicating the health condition is equivalent to full health) and 1 (indicating the health condition is equivalent to death).

The EBD of each end-point was estimated using the following information and data:

- the distribution of environmental noise exposure within the population;
- the exposure–response relationships for the particular health end-point;
- the population-attributable fraction due to environmental noise exposure;
- a population-based estimate of the incidence or prevalence of the health end-point from surveys or routinely reported statistics; and
- the value of DW for each health end-point.

Cardiovascular diseases

The evidence from epidemiological studies on the association between exposure to road traffic and aircraft noise and hypertension and ischaemic heart disease has increased during recent years. Road traffic noise has been shown to increase the risk of ischaemic heart disease, including myocardial infarction. Both road traffic noise and aircraft noise increase the risk of high blood pressure. Very few studies exist regarding the cardiovascular effects of exposure to rail traffic noise.

Exposure-response relationships

Numerical meta-analyses were carried out assessing exposure–response relationships between community noise and cardiovascular risk. A polynomial function was fitted through the data points from the analytic studies within the noise range from 55 to 80 dB(A):

$$OR = 1.63 - 6.13 \cdot 10^{-4} \cdot L^2_{day,16h} + 7.36 \cdot 10^{-6} \cdot L^3_{day,16h}$$

Estimated burden in western Europe

Based on the exposure data from the noise maps of EU Member States, it is estimated that the burden of disease from environmental noise is approximately 61 000 years for ischaemic heart disease in high-income European countries.

Cognitive impairment in children

The case definition of noise-related cognitive impairment is: The Reduction in cognitive ability in school-age children that occurs while the noise exposure persists and will persist for some time after the cessation of the noise exposure. The extent to which noise impairs cognition, particularly in children, has been studied with both experimental and epidemiological studies.

Hypothetical exposure-response relationship

Based on available evidence, a hypothetical exposure–response relationship between noise level (L_{dn}) and risk of cognitive impairment was formulated: all of the noise-exposed children were cognitively affected at a level as high as 95 dB(A) L_{dn}, and no children were affected at a relatively low level, such as 50 dB(A) L_{dn}. A linear relationship in the range of these two limits was assumed as a basis for a conservative approximation of YLD.

Estimated burden in western Europe

If one extrapolates the exposure distribution and population structure of Sweden to western European countries, the estimated DALYs for the EUR-A countries are 45 000 years for children aged 7–19 years.

Sleep disturbance

Sleep disturbance can be measured electro-physiologically or by self-reporting in epidemiological studies using survey questionnaires. In epidemiological studies, "self-reported sleep disturbance" is the most easily measurable outcome indicator, because electro-physiological measurements are costly and difficult to carry out on large samples and may themselves influence sleep.

Exposure–response relationship

The percentage of "highly sleep disturbed" persons (*HSD*) as a function L_{night} was calculated with the equation:

$$HSD[\%] = 20.8 - 1.05 \cdot L_{night} + 0.01486 \cdot L_{night}^2$$

Estimated burden in western Europe

Conservative estimates applied to the calculation using exposure data from noise maps give a total of 903 000 DALYs lost from noise-induced sleep disturbance for the EU population living in towns of > 50 000 inhabitants.

Tinnitus

Tinnitus is defined as the sensation of sound in the absence of an external sound source. Tinnitus caused by excessive noise exposure has long been described; 50% to 90% of patients with chronic noise trauma report tinnitus. In some people, tinnitus can cause sleep disturbance, cognitive effects, anxiety, psychological distress, depression, communication problems, frustration, irritability, tension, inability to work, reduced efficiency and restricted participation in social life.

Exposure-response relationship

For tinnitus due to environmental noise, exposure to social/leisure noise such as personal music players, gun shooting events, music concerts, sporting events and events using firecrackers is most relevant for western Europe and North American countries. Population-based studies associating exposure to leisure noise with the risk of tinnitus are rare. From studies on people with tinnitus, a mean prevalence was calculated of those with slight, moderate and severe tinnitus.

Estimated burden in western Europe

Applying the mean prevalence data to the EUR-A population of 344 131 386 people aged 15 years and over in 2001, the prevalence of slight, moderate and severe tinnitus was estimated. DW of 0.01 was chosen for slight tinnitus and 0.11 for moderate and severe tinnitus. An educated guess of 0.03 was made for the population-attributable fraction of tinnitus caused by environmental noise exposure. DALYs for noise-induced tinnitus were estimated to be 22 000 years for the EUR-A adult population.

Annoyance

WHO defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Therefore, a high level of annoyance caused by environmental noise should be considered as one of the environmental health burdens. Standardized questionnaires are used to assess noise-induced annoyance at the population level. The percentage of highly annoyed is the most widely used prevalence indicator for annoyance in a population.

Exposure-response relationship

The percentage of "highly annoyed" persons (HA) due to road traffic noise was calculated with the equation:

$$HA[\%] = 0.5118 \cdot (L_{den} - 42) - 1.436 \cdot 10^{-2} \cdot (L_{den} - 42)^2 + 9.868 \cdot 10^{-4} \cdot (L_{den} - 42)^3$$

Estimated burden in western Europe

Conservative estimates applied to the calculation using exposure data from noise maps give a total of 587 000 DALYs lost from noise-induced annoyance for the EU population living in towns of > 50 000 inhabitants.

Conclusions

There is sufficient evidence from large-scale epidemiological studies linking the population's exposure to environmental noise with adverse health effects. Therefore, environmental noise should be considered not only as a cause of nuisance but also a concern for public health and environmental health.

This publication was produced by the working group convened by the Regional Office to provide policy-makers and their advisers in national and local authorities with exemplary practices of using WHO methods of quantifying the burden of disease for selected health end-points. Because of the uncertainties in exposure assessment, exposure–response relationships and health statistics, conservative assumptions were made as far as possible.

It is estimated that DALYs lost from environmental noise in the western European countries are 61 000 years for ischaemic heart disease, 45 000 years for cognitive impairment of children, 903 000 years for sleep disturbance, 22 000 years for tinnitus and 587 000 years for annoyance. If all of these are considered together, the range of burden would be 1.0–1.6 million DALYs.[1] This means that at least 1 million healthy life years are lost every year from traffic-related noise in the western European countries, including the EU Member States. Sleep disturbance and annoyance related to road traffic noise constitute most of the burden of environmental noise in western Europe. Owing to a lack of exposure data in south-east Europe and the newly independent states, it was not possible to estimate the disease burden in the whole of the WHO European Region.

The procedure of estimating the burden of selected health end-points related to environmental noise exposure presented here can be used by international, national and local authorities as long as the assumptions, limitations and uncertainties reported in this publication are carefully taken into account. This publication also provides an updated review of evidence for the future development of suitable guidelines on noise by WHO, as its urged by Member States in the Parma Declaration adopted at the Fifth Ministerial Conference on Environment and Health in 2010.

1 The extent to which years lost from different effects are additive across different outcomes is unclear. The different health outcomes might have synergistic rather than antagonistic effects when the combined effects occur in a person. Therefore, it would be a prudent approach to add the DALYs of different outcomes without considering synergistic effects.

1. INTRODUCTION

Lin Fritschi
A. Lex Brown
Rokho Kim
Dietrich Schwela
Stelios Kephalopoulos

Noise is a major environmental issue, particularly in urban areas, affecting a large number of people. To date, most assessments of the problem of environmental noise have been based on the annoyance it causes to humans, or the extent to which it disturbs various human activities. Assessment of health outcomes potentially related to noise exposure has so far been limited *(1)*.

According to preliminary results from the Environmental Burden of Disease (EBD) in Europe project in six European countries *(2)* reported at the WHO Ministerial Conference held in Parma in March 2010 *(3)*, traffic noise was ranked second among the selected environmental stressors evaluated in terms of their public health impact in six European countries. Further, the trend is that noise exposure is increasing in Europe compared to other stressors (e.g. exposures to second hand smoke, dioxins and benzene), which are declining.

In its *Guidelines for community noise (4)*, the WHO defined environmental noise as "noise emitted from all sources except for noise at the industrial workplace". European Union (EU) Directive 2002/49/EC on the management of environmental noise *(5)* defines environmental noise as "unwanted or harmful outdoor sound created by human activities, including noise from road, rail, airports and from industrial sites". The terms community, residential or domestic noise have also been applied to environmental noise, although these terms are not necessarily used consistently. This publication examines health risk assessment for these sources of environmental noise.

In recent years, evidence has accumulated regarding the health effects of environmental noise. For example, well-designed, powerful epidemiological studies have found cardiovascular diseases to be consistently associated with exposure to environmental noise. In order to inform policy and to develop management strategies and action plans for noise control, national and local governments need to understand and consider this new evidence on the health impacts of environmental noise. For this purpose, there should be a risk assessment to evaluate the extent of the potential health effects.

The process of risk assessment of environmental noise requires knowing:

- the nature of the health effects of noise;
- the levels of exposure at which health effects begin to occur and how the extent of the effect changes with increasing noise levels; and
- the number of people exposed to these hazardous levels of noise.

Quantitative risk assessments based on EBD methodology have been developed and used by WHO to help the Member States quantify several environment-related health problems *(6)*. The EBD is usually expressed as the number of deaths and the metric disability-adjusted life year (DALY), which combines the concepts of (*a*) potential years of life lost due to premature death and (*b*) equivalent years of "healthy" life lost by virtue of being in a state of poor health or disability. An estimate for burden of disease due to noise exposure has been made in Germany and other European countries as well as by nongovernmental organizations.

In recent years, the Bonn Office of the WHO European Centre for Environment and Health has organized several meetings of experts to examine the current state of knowledge and to further develop approaches for quantifying the effect of noise on health. The outcomes of these meetings are summarized in this publication.

Aims of this publication

The target audience for this publication is primarily policy-makers and their technical advisers who need to evaluate the issue of environmental noise in their jurisdictions. Publication brings together information on the evidence base on the health effects of environmental noise and provides guidance on how to quantify these effects. It aims to provide:

- synthesized reviews of evidence on the relationship between environmental noise and health effects in order to inform policy-makers and the public about the health impacts of exposure to noise;

- exemplary estimates of the health impacts of environmental noise based on exposure–response relationships, exposure distribution, population-attributable fraction, background prevalence of disease and disability weights; and

- guidance on the process of health risk assessment of environmental noise consistent with the EBD methodology of WHO.

This publication has been prepared with a European focus in terms of policy, available data and legislation. Nevertheless, as long as the assumptions, limitations and uncertainties described in the various chapters are carefully taken into account, the processes of risk assessment illustrated here can also be applied outside Europe.

Risk assessment

The objective of risk assessment is to support decision-making by assessing risks of adverse effects on human health and the environment from chemicals, physical factors and other environmental stresses. There are several different frameworks available to guide risk assessment. The one used in this publication is the framework outlined in the WHO guideline publication *Evaluation and use of epidemiological evidence for health risk assessment (7)*. Other frameworks are used by other organizations *(8,9)*.

The WHO model splits health risk assessment into two activities: health hazard characterization and health impact assessment *(7)*. The results of risk assessment can be fed into risk management, including regulatory options. This publication focuses on health impact assessment aspect of risk assessment; the management of risk from environmental noise is not discussed here.

The process of risk assessment involves the synthesis and interpretation of the evidence from the available data, often across scientific disciplines. There are several limitations, challenges and uncertainties at each step. These include the availability and consistency of the evidence, chance and bias affecting the validity of studies, and the transparency, reproducibility and comprehensiveness of reviews.

Hazard identification (identification of effects of noise)

After reviewing the available scientific evidence supporting causal association, the following outcomes were selected for inclusion:

- cardiovascular disease
- cognitive impairment
- sleep disturbance
- tinnitus
- annoyance.

While a chapter on hearing impairment due to environmental noise would have been useful, it was found that the data available on the prevalence of leisure noise and the relationship between environmental noise and hearing impairment were not adequate for burden of disease calculations.

On the other hand, it was thought to be important to include a chapter on the effect of environmental noise on annoyance. Although annoyance cannot be classified as a "health effect", it does affect the well-being of many people and therefore may be considered to fall within the WHO definition of health as being "a state of complete physical, mental and social well-being". More importantly, however, it is the effect of noise that most lay people are aware of and concerned about. It was believed that many jurisdictions would be interested in estimating the effects of noise on this outcome.

Exposure assessment

There are many different sources of environmental noise to which people are exposed including, for example:

- transport (road traffic, rail traffic, air traffic);
- construction and industry;
- community sources (neighbours, radio, television, bars and restaurants); and
- social and leisure sources (portable music players, fireworks, toys, rock concerts, firearms, snowmobiles, etc.).

Noise from all sources may be relevant to the assessment of risk, and hence it may be appropriate to assess the exposure of the population of interest to all of these sources. In practice, it is almost impossible to consider exposure to all sources in the risk assessment, because some exposures are difficult to estimate at the population level (for example, leisure noise through attending music concerts or listening to personal music devices). By contrast, considerable work has been done on assessing the exposure of populations to noise sources such as air traffic and road traffic.

Assessment of exposure to noise requires consideration of many factors, including:

- measured exposure or calculated/predicted exposure
- choice of noise indicator
- population distribution
- time-activity patterns of the exposed population
- combined exposures to multiple sources of noise.

The exposure of the population of interest to the noise source can be obtained by measurement or by using models that calculate noise exposure based on information about the source and on information about sound propagation conditions from source to receiver. Such calculation models can also be used to predict levels of noise exposure for some time in the future based on estimated changes in noise sources. Best-practice methods should be adopted for measurement or for calculation in the assessment of exposure, with a full understanding of the assumptions, limitations and potential errors associated with any approach to measurement or estimation. For example, a common approach to assessing the exposure of people to transport noise is to use, as a proxy, the exposure of the most exposed side of the dwelling in which they live. This may not always be a good approximation, however, because the rooms in which people spend most time may not be on the most exposed side of the dwelling.

Noise exposure mapping is a commonly adopted step in the process of estimating the noise exposure of a population. EU Directive 2002/49/EC on the management of environmental noise *(5)* mandated all EU Member States to produce strategic noise maps based on harmonized indicators by 2008 (see Box 1.1).

Box 1.1. EU Directive 2002/49/EC on the management of environmental noise

Noise has high priority on lists of environmental issues in Europe and noise reduction has increasingly become a focus for EU legislation and management. From the 1970s, successive directives have laid down specific noise emission limits for most road vehicles and for many types of outdoor equipment. Despite this increasingly stringent control of emissions, however, and despite the considerable effort and progress made in controlling noise from industry, there has been little improvement in the levels of noise exposure of people across Europe. The European Commission's 1996 Green Paper on future noise policy *(11)* marked the start of an extended "knowledge based" approach to the problem of noise, with a special emphasis on assessing and then managing the exposure of the population to environmental noise.

The European Commission developed a new framework for noise policy based on shared responsibility between the EU and national and local governments. It included a comprehensive set of measures to improve the accuracy and standardization of data to help improve the coherency of different actions:

- the creation of a Noise Expert Network *(12)*, whose mission is to assist the Commission in the development of its noise policy;

- EU Directive 2002/49/EC on the management of environmental noise *(5)*; and
- the follow-up and further development of existing EU legislation relating to sources of noise such as motor vehicles, aircraft and railway rolling stock, and the provision of financial support to noise-related studies and research projects.

The European Parliament and Council adopted Directive 2002/49/EC of 25 June 2002, whose main aim is to provide a common basis for tackling noise problems across the EU. The underlying principles of the Directive are similar to those for other environment policy directives:

- monitoring the environmental problem by requiring competent authorities in Member States to produce strategic noise maps for major roads, railways, civil airports and urban agglomerations, based on harmonized noise indicators;
- informing and consulting the public about noise exposure, its effects and the measures considered to address noise, in line with the principles of the Aarhus Convention *(13)*;
- addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good (the Directive does not set any limit value nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities); and
- developing a long-term EU strategy, including objectives to reduce the number of people affected by noise and providing a framework for developing existing EU policy on noise reduction from sources.

Detailed information is available on the authorities responsible for implementing the Directive in Member States and on the agglomerations, major roads, railways and airports to be covered by the noise maps and action plans.

Exposure assessment requires specification of the noise metric that is to be utilized. There is a wide variety of noise indicators and extensive discussion of these can be found in the WHO *Guidelines for community noise (4)*. This includes such matters as the type of physical scale and the period of the day over which exposure is to be integrated: for example, "night", "evening" or "day".

The EU has adopted harmonized noise metrics across all of its Member States, suggesting L_{den} (day-evening-night equivalent level) as an appropriate metric to assess annoyance and L_{night} (night equivalent level) as a metric to assess sleep disturbance *(5)*. While noise limits are set individually by each EU Member State, these suggested metrics are to be used for strategic mapping of exposure in all countries. They are common across all transport sources and other sources of environmental noise. Definitions of these metrics in Directive 2002/49/EC are paraphrased in Box 1.2 below. Strategic noise maps using these harmonized noise metrics are to be used throughout Europe to assess the number of people exposed to different levels of noise. This information on population exposure can be used in the risk assessment process for environmental noise. Directive 2002/49/EC also allows the use of supplementary noise metrics (other than L_{den} and L_{night}) to monitor or control special noise situations.

A key consideration is that risk assessment cannot be carried out (using an exposure-specific approach) unless both the exposure assessment and the exposure–response relationship utilize the matching noise indicators. This becomes an issue when there is evidence that the best relationship between a particular health effect and exposure may be based on one indicator, yet data on exposure are only available based on another. While the work required by Directive 2002/49/EC will increase the availability of exposure assessments using the harmonized noise indicators, available exposure–response relationships may be reported using other indicators. These matters are discussed within each of the chapters on the various health outcomes. Exposure–response relationships reported may utilize different noise indicators because the meta-analyses in which these relationships were derived relied on studies using other noise indicators, or because there is evidence that the relationship between a particular health outcome and noise exposure is better described using a different noise indicator.

The quality of exposure data is critical to the accuracy of risk assessment. Some of the difficulties in measuring noise and preparing noise maps are outlined in a good practice guide *(14)*. They include: coverage of all relevant sources; inaccuracies in the process of linking people to noise levels and thus obtaining exposure distributions; and accounting for the presence of a quiet side or special sound insulation of a house, in particular for effects related to sleeping.

Box 1.2. Harmonized noise indicators in EU Directive 2002/49/EC

The day-evening-night level L_{den} in decibels is defined by:

$$L_{den} = 10 \cdot \lg \frac{1}{24} \cdot \left(12 \cdot 10^{\frac{L_{day}}{10}} + 4 \cdot 10^{\frac{L_{evening}+5}{10}} + 8 \cdot 10^{\frac{L_{night}+10}{10}} \right)$$

- L_{day}, $L_{evening}$ and L_{night} are the A-weighted 12, 4, 8 hours average sound levels, respectively, as defined in ISO 1996-2:1987 *(15)*.
- The day is 12 hours, the evening 4 hours and the night 8 hours. Member States may shorten the evening period by 1 or 2 hours and lengthen the day and/or the night period accordingly (same for all the sources).
- The start of the day (and consequently the start of the evening and the start of the night) shall be chosen by the Member State (same for all sources); the default values are 07:00–19:00, 19:00–23:00 and 23:00–07:00 local time.
- The incident sound is considered, which means that no account is taken of the sound that is reflected at the facade of the dwelling under consideration.

The nighttime noise indicator L_{night} is the A-weighted long-term average sound level.

- The night is 8 hours as defined above.

Supplementary noise indicators. In some cases, in addition to L_{den} and L_{night}, and where appropriate L_{day} and $L_{evening}$, it may be advantageous to use special noise indicators and related limit values. Some examples (consult Directive 2002/49/EC for full advice) are:

- a very low average number of noise events in one or more of the periods (for example, less than one noise event an hour); a noise event could be defined as a noise that lasts less than five minutes, such as the noise from a passing train or aircraft;
- strong low-frequency content of the noise; and
- L_{Amax} or SEL (sound exposure level) for night period protection in the case of noise peaks.

Environmental burden of disease assessment

A detailed introduction to the calculation of EBD is available elsewhere *(16,17)*. In this section, we describe the main methods used to calculate EBD that are applied in the following chapters on each health outcome of environmental noise, and discuss some of the strengths and weaknesses of each approach.

In general, the number of deaths and cases of each of the outcomes is estimated in the initial process of EBD calculation. The burden of disease is expressed in deaths and DALYs. The DALY combines in one measure the time lived with disability (YLD) and the time lost due to premature mortality (YLL) in the general population:

$$DALY = YLL + YLD$$

The YLD is the number of incident cases (I) multiplied by a disability weight (DW) and an average duration of disability in years (L):

$$YLD = I \cdot DW \cdot L$$

The YLL essentially corresponds to the number of deaths (N) multiplied by the standard life expectancy at the age at which death occurs (L):

$$YLL = N \cdot L$$

These simple formulae can be further adjusted by discounting for the timing of the health effect (now or in the future) and by the relative value of a year of life lived at different ages using different assumptions (age weighting).

The approach to estimating total disease burden can be summarized in the following steps: (*a*) estimating the exposure distribution in a population; (*b*) selecting one or more appropriate relative risk estimates from the literature, generally from a recent meta-analysis; and (*c*) estimating the population-attributable fraction with the formula for population-attributable fraction. This is referred to in this volume as the exposure-based approach. In certain instances, the number of cases is also directly estimated on the basis of the exposure (outcome-based approach).

Exposure-based approach

This approach uses the distribution of noise exposure within the study population to estimate the fraction of disease in the population that is attributable to noise. This is then applied to the disease estimates. This approach requires the measurement or calculation of:

- the distribution of the exposure to environmental noise within the population (prevalence of noise exposure);
- the exposure–response relationship for the particular outcome;
- a population-based estimate of the incidence or prevalence of the outcome from surveys or routinely reported statistics; and
- a value of DW for each health outcome.

Prevalence of noise exposure

Estimates are required of the distribution of the exposure in the population of interest using the chosen noise metric.

Exposure-response relationship

Exposure–response relationships are usually obtained from epidemiological studies. The validity of any exposure–response relationship depends on the quality of the studies used to derive it, the choice of studies used and the modelling process used to pool the results. It is therefore very important that the process to derive the exposure–response relationships is well defined. In some cases, very well-designed studies can provide this information. In other cases, it is necessary to undertake a meta-analysis to combine a number of different studies. According to the WHO guidelines *(4)*, the process of meta-analysis should include, as a minimum:

- a systematic review of the available epidemiological information on exposure–response relationships;
- an inventory of studies that provide quantitative information on exposure or that allow linkage to such information;
- additional selection of studies according to clear inclusion criteria; and
- a meta-analysis of published results or pooling of original data.

The exposure–response relationship may be reported as a regression formula or as a relative risk measure for a given change in noise (or comparing noise-exposed to noise-unexposed). Important issues to consider in the meta-analysis are:

- the quality of studies that have been used in the meta-analysis and the selection criteria used;
- the completeness of the search for studies;
- the quality of the assessment of noise exposure;
- the temporality of the noise exposure (for example, nighttime noise exposure is relevant for sleep disturbance, while daytime noise exposure is important for annoyance and cognitive impairment); and
- the relevance of the published studies to the population for which the risk assessment is being carried out.

In addition, it may be necessary to extrapolate relationships beyond the range of exposure observed in the available epidemiological studies. The arguments for the validity of such an extrapolation must be stated.

Incidence (or prevalence) of outcome

The definition of health outcome in the exposure–response relationship should be consistently used when the incidence data are collected. Some outcomes are easily obtained from national health statistics. For example, deaths from cardiovascular disease in a population per year are routinely collected in most developed countries.

For other outcomes, such routine data may not be available and in these cases prevalence or incidence of outcomes may need to be determined by surveys of the population. The accuracy of the estimates of these outcomes depends on the questions used for each individual survey. Standardized and validated questionnaires are recommended. For example, asking people how often they take medication to overcome sleeping difficulties may differ according to the availability of medication and the definition of sleeping difficulties implicit in the question. The timing of the outcome is important, either reflecting lifetime prevalence ("Have you ever had ...?"), point prevalence ("Do you currently have ...?") or incidence ("Since the last survey have you developed new ...?"). Depending on the condition, severity may be important as different severities of the outcome may have different DWs (e.g. mild, moderate or severe hearing loss).

Attributable fraction

The attributable fraction is the proportion of disease in the population that is estimated to be caused by noise. The accuracy of the fraction of the outcome attributable to environmental noise may also be difficult to specify. If the distribution of exposure and the exposure–response relationship are known, the population-attributable risk percentage can be estimated for a population (see above). The following formulae can be used to calculate the attributable risk percentage (AR%), the population-attributable risk percentage (PAR%), and the population-attributable risk (PAR) for each noise category *(16)*:

$AR\% = (RR-1) / RR \cdot 100\ [\%]$

$PAR\% = P_e/100 \cdot (RR-1) / (P_e/100 \cdot (RR-1) + 1) \cdot 100\ [\%]$

$PAR = PAR\% / 100 \cdot N_d$

RR = relative risk (odds ratios are estimates of the relative risk)

P_e = percentage of the population exposed [%]

N_d = number of subjects with disease (disease occurrence).

A more generalized formula for the calculation of the population-attributable fraction (PAF) that better accounts for multiple comparisons for large relative risks may also be used:

PAF $= \{\Sigma(P_i \cdot RR_i) - 1\} / \Sigma (P_i \cdot RR_i)\}$

P_i = proportion of the population in exposure category i

RR_i = relative risk at exposure category i compared to reference level

$\Sigma P_i = 1$

PAR $= PAF \cdot N_d$

Disability weight

DWs allow non-fatal health states and deaths to be measured under a common unit *(15)*. DWs quantify time lived in various health states to be valued and quantified on a scale that takes account of societal preferences. DWs that are commonly used for calculating DALYs are measured on a scale of 0–1, where 1 represents death and 0 represents ideal health.

The values of DWs for various disease states have been the subject of considerable discussion and work. They are generally derived from expert panels. This work has been documented extensively *(17)* and will not be summarized further here. WHO has a reasonably comprehensive list of DWs *(17)* and these are recommended for use. If there is no appropriate DW, then an expert committee may be asked to find an appropriate DW by analogy with other known DWs.

Advantages and disadvantages of this method

The methods described above are the most common approach used in health risk assessments because the methodology has been established and accepted in comparative risk analysis of WHO's EBD projects *(16)*. They provide standardized estimates of the health risk due to noise that may be understood by workers in the field. However, as described above, these methods require detailed data on noise exposure, the outcome and the exposure–response relationship. Such data are not always easy to obtain and often have significant limitations. For example, the exposure–response relationships may be based on extrapolation from a small number of studies with few subjects and perhaps even a measure of noise exposure that is not available on a population basis. This means that the estimates usually suffer from a considerable degree of uncertainty. This uncertainty is very difficult to quantify, although it is sometimes possible to provide low and high limits using sensitivity analyses *(17)*.

Outcome-based approach

For some noise-related outcomes, such as sleep disturbance and tinnitus, it is possible to estimate the burden directly through national or international surveys. This approach requires:

- an estimate of the prevalence of the outcome attributable to environmental noise; and
- a value of DW corresponding to this outcome.

The choice of questions in the survey needs to be carefully considered so as to be able to differentiate various severities of outcome and be compatible with the DWs. When the data on outcomes are not specific to environmental noise, attributable fractions should be applied to the data. When information on population exposure and/or the exposure–response relationship is not known, expert opinion may be sought on what proportion of cases of an outcome is due to environmental noise. This approach was used for the chapter for tinnitus in this report, because exposure data on leisure noise and exposure–response relationships are not available for tinnitus.

The number of cases can then be multiplied by the DW to obtain the DALYs. When using this method, the attribution of the cause of the outcome tends to be more subjective than in exposure-based approaches.

Process of developing this publication

There is currently little information at the international level on the health impact of environmental noise in the WHO European Region. The WHO Regional Office for Europe has carried out an assessment study to provide methodological guidance for estimating the burden of disease related to environmental noise by calculating preliminary estimates of DALYs for the European Region.

The noise EBD project was started in 2005. An expert working group was convened in Stuttgart in June 2005 to review the health effects of noise and the selection of noise-related health outcomes for EBD estimation. Cardiovascular disorders, cognitive impairment, sleep disturbance, hearing loss, tinnitus and annoyance were selected as outcomes to be considered.

A second meeting was held in Bern in December 2005 to review the initial estimates of the burden of disease from environmental noise. Experts provided background documents and made presentations reviewing the detailed methods and preliminary results of EBD assessment for the selected noise-related outcomes. For each topic, a state-of-the-art review was made regarding the exposure data, exposure–response relationships, outcome data, DW and DALY calculation. WHO staff provided the topic-specific experts with methodological guidance based on previous global burden of disease experience. The meeting identified methodological constraints and informational gaps in quantification of DALYs due to environmental noise.

The methods and preliminary estimates were further elaborated in Berlin in April 2006 and in Bonn in December 2006. It was noted that calculation of DALYs is not possible for more than a few countries owing to the limited availability of data in most European countries. Because of this difficulty, the working group had to focus on providing methodological guidance on risk assessment rather than on estimating the EBD of environmental noise. Because EU Directive 2002/49/EC provides exposure data in many countries, it was also decided that the exposure metrics should use the Directive indicators as much as possible. With these aims in mind, a meeting of experts was convened in Bonn in May 2008.

Subsequent to the Bonn meeting, the authors of this chapter edited the final document. All chapters have been peer-reviewed, both within the working group and externally. At the final compilation of the chapters on health outcomes, the chapter on hearing loss was excluded because of a lack of epidemiological data pointed out by the reviewers. All other chapters were revised by the authors, taking into account the comments of the reviewers.

In 2010, exposure data on urban areas of > 250 000 inhabitants in the EU Member States became available through the EEA with the enforcement of EU Directive 2002/49/EC *(18)*. Accordingly, the WHO secretariat decided to include the EBD calculations for the EU population using the available data. In every step of the calculation that involved uncertainties, the working group made conservative assumptions in filling the information gap in order to avoid any possibility of overestimation.

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2. ENVIRONMENTAL NOISE AND CARDIOVASCULAR DISEASE

Wolfgang Babisch
Rokho Kim

This chapter examines the burden of cardiovascular diseases related to environmental noise. It is a common experience that noise is unpleasant and affects the quality of life. It disturbs and interferes with activities of the individual, including concentration, communication, relaxation and sleep *(1,2)*. Besides the psychosocial effects of community noise, there is concern about the impact of noise on public health, particularly regarding cardiovascular outcomes *(3–5)*.

According to the WHO Global Burden of Disease 2000 study, ischaemic heart disease is the leading cause of death in developed and developing countries (22.8% and 9.4% of total deaths, respectively *(6,7)*. Worldwide, 12.6% of deaths are caused by ischaemic heart disease, 9.6% by cerebrovascular disease and 1.6% by hypertensive heart disease *(8)*. High blood pressure and high levels of blood lipids, including cholesterol and triglycerides, are major (biological or endogenous) risk factors for ischaemic heart disease. Endogenous risk factors can be affected by exogenous risk factors (e. g. nutrition, environmental factors). Worldwide, 13.5% of deaths are attributable to high blood pressure (hypertension) and 6.9% to high (total) cholesterol levels. 1.4% of deaths are attributed to urban air pollution according to the WHO Global Burden of Disease 2000 study *(6,8)*.

The auditory system is continuously analysing acoustic information, which is filtered and interpreted by different cortical and sub-cortical brain structures. Arousal of the autonomic nervous system and the endocrine system is associated with repeated temporal changes in biological responses. In the long run, chronic noise stress may affect the homeostasis of the organism due to dysregulation, incomplete adaptation and/or the physiological costs of the adaptation *(9–17)*. Noise is considered a nonspecific stressor that may cause adverse health effects in the long run. Epidemiological studies suggest a higher risk of cardiovascular diseases, including high blood pressure and myocardial infarction, in people chronically exposed to high levels of road or air traffic noise. This chapter collates the available evidence regarding risk estimation for the burden of cardiovascular disease attributable to environmental noise in European regions.

Definition of outcome

Cardiovascular disease includes ischaemic heart disease, hypertension (high blood pressure) and stroke. There is no evidence available on the relationship between noise and stroke, so it will not be considered further here.

Ischaemic heart diseases (ICD 10 codes I20–I25) include angina (I20), acute myocardial infarction (I21), subsequent myocardial infarctions and complications of infarctions (I22 and I23), other acute forms of ischaemic heart disease (I24) and chronic ischaemic heart disease (I25). Essential hypertension is classified as I10 with further codes for hypertensive heart failure (I11), hypertensive renal disease (I12) and hypertensive heart and renal disease (I13).

Summary of evidence linking noise and cardiovascular disease

Epidemiological studies on the relationship between transportation noise (particularly road traffic and aircraft noise) and cardiovascular effects have been carried out on adults and on children, focusing on mean blood pressure, hypertension and ischaemic heart diseases as cardiovascular end-points. The evidence, in general, of a positive association has increased during recent years *(18–20)*. While there is evidence that road traffic noise increases the risk of ischaemic heart disease, including myocardial infarction, there is less evidence for such an association with aircraft noise because of a lack of studies. However, there is increasing evidence that both road traffic noise and aircraft noise increase the risk of hypertension. Very few studies on the cardiovascular effects of other environmental noise sources, including rail traffic, are known. Numerical meta-analyses were carried out assessing exposure–response relationships in quantitative terms *(21,22)* and the issue has been addressed in various WHO projects. The exposure–response curves presented here refer to the data collected for these projects, to illustrate the processes of a quantitative risk assessment.

Biological model of causation

Non-auditory health effects of noise have been studied in humans and animals for several decades, using laboratory and empirical methods. Biological reaction models have been derived, based on the general stress concept *(17,23–30)*. Noise is a nonspecific stressor that arouses the autonomous nervous system and the endocrine system *(9,11–14,31,32)* (C. Maschke & K. Hecht, unpublished data, 2005). A neuro-endocrinological definition of stress is that it is a state that threatens homeostatic or adaptable systems in the body *(16,33,34)*. Increased allostatic load is associated with various diseases, including ischaemic heart disease *(35)*. The epidemiological reasoning is based on three facts. First, experimental studies in the laboratory have been carried out for a long time and revealed an increased vegetative and endocrine reactivity during periods of exposure *(1,36–70)*. However, the question regarding long-term effects of chronic noise exposure cannot be answered from short-term experiments. Second, animal studies have shown manifest disorders in species exposed to high levels of noise for a long time *(71–83)*. However, effects in humans and animals cannot be directly compared, particularly because two pathways may be relevant – the direct effect due to nervous innervation and the indirect effect due to the cognitive perception of the sound; the latter is certainly different in humans. Furthermore, noise levels in animal studies were higher than in ambient situations. Third, occupational studies have shown health disorders in workers chronically exposed to noise for many years *(20,84–98)*. However, noise levels were higher than in the ambient environment. Epidemiological research has therefore been carried out with respect to community noise levels to test the hypothesis and to quantify the risk.

Among other non-auditory health end-points, short-term changes in circulation, including blood pressure, heart rate, cardiac output and vasoconstriction, as well as stress hormones (epinephrine, norepinephrine and corticosteroids), have been studied in experimental settings for many years *(32,99)*. Classical biological risk factors have been shown to be elevated in subjects that were exposed to high levels of noise *(44,54,79,100–111)*.

From this, the hypothesis emerged that persistent noise stress increases the risk of cardiovascular disorders, including hypertension and ischaemic heart disease. According to the noise/stress reaction model, the arousal of the endocrine and autonomic nervous system affects classical biological risk factors (e.g. blood pressure, blood lipids, glucose regulation, blood flow, haemostatic factors and cardiac output). Chronic metabolic changes or dysfunction due to noise increase the risk of manifest diseases, including hypertension, arteriosclerosis and myocardial infarction.

Exposure-response relationship

For a quantitative risk assessment and the derivation of guidelines for public health noise policy, a common exposure–response curve is required. The risk estimates obtained from different noise studies can be summarized using the statistical approach of meta-analysis.

Definition of exposure

Energy-based indicators of exposure (L_{eq}) are adequate and sufficient for assessing the relationship between long-term exposure to community noise and chronic diseases such as cardiovascular disorders. While single event noise indicators can be useful predictors (as additional information) for assessing the effects of acute noise (e. g. sleep disturbance) *(112)*, integrated noise indicators (e.g. a year's average noise level) are suitable predictors in epidemiological studies for assessing the long-term effects of chronic noise exposure. Such indicators should measure noise during certain periods of the day. Examples include $L_{day,16h}$ (day-noise indicator 7:00 to 23:00), $L_{day,12h}$ + $L_{evening,4h}$ (day-noise indicator 7:00 to 19:00 and evening-noise indicator 19:00 to 23:00) and $L_{night,8h}$ (night-noise indicator 23:00 to 7:00). $L_{day,16h}$ is a useful indicator for estimating health impacts according to the method proposed here. When information on noise for the various periods of the day, i.e. day/evening/night, is available, weighted and non-weighted indicators can easily be calculated for use in health studies and related quantitative risk assessment. This includes the indicators L_{den} (weighted day-evening-night noise indicator) and L_{night} according to Directive 2002/49/EC *(113)*, which are considered in noise mapping.

If only one figure is anticipated to describe the noise situation, a single noise indicator may be a useful factor to be considered in noise studies (e.g. L_{24h}, L_{dn} or L_{den}). However, since night noise is assessed separately according to Directive 2002/49/EC, it does not appear reasonable when daytime noise and nighttime noise exposures are then combined in a weighted 24-hour indicator. With respect to health effects, it would make much more sense to clearly distinguish between real day and night indicators. An optimal noise study would try to distinguish between the exposure of the living room during the day (L_{day}) and the exposure of the bedroom during the night (L_{night}). Further, the concept of L_{den} is annoyance-based. From a cardiovascular point of view, there is no rationale known for weighing factors such as +5 dB(A) or +10 dB(A) for the evening and night periods of the day. It would be a better approach to consider day and night exposures separately with respect to its effects, particularly for noise sources other than road traffic noise (where the day and night noise levels are usually highly correlated). Studies should also try to distinguish between the exposure of the living room (during daytime) and the exposure of the bedroom (during nighttime). However, such information is often not available.

When comparing study results for the meta-analyses, problems arise from the fact that different noise indicators (including even more complex national noise indices) have been used in different studies. However, conversion formulas are available for approximation. For example, with respect to road traffic noise the following empirical formula can be used for conversions between $L_{day,16h}$ and L_{den} *(114)*:

$$L_{den} \approx L_{day,16h} - 2 \cdot \ln((L_{day,16h} - L_{night,8h})/22.4))$$

However, this conversion can, per se, not be applied to other noise sources such as aircraft noise and railway noise. Nevertheless, as long as particular studies referring to Directive 2002/49/EC indicators L_{den} and L_{night} are largely missing, exposure–response relationships (regression coefficients) based on other noise indicators could approximately be considered for assessing the relative increase in risk with increasing noise level.

For the meta-analyses, noise exposure was divided into 5-dB(A) categories for the daytime outdoor average A-weighted sound pressure level ($L_{day,16h}$). This was considered in most studies. Information on nighttime exposure ($L_{night,8h}$) was seldom available. Newer studies used non-weighted or weighted averages of the 24-hour exposure (L_{eq}, L_{dn}, L_{den}) *(113)*. Some aircraft noise studies used national calculation methods (e.g. Dutch Kosten Units). Some of the studies considered subjective ratings of the noise, including noise annoyance, as indicators of noise exposure. Sound levels were converted on the basis of best-guess approximations to $L_{day,16h}$ for comparison and pooling.

In urban settings, average nighttime noise levels for road traffic tend to be approximately 7–10 dB(A) lower than average daytime levels and are relatively independent of the traffic volume of the street (except motorways) *(115–117)*. Measurements showed that L_{den} was approx. 1–3 dB(A) higher than $L_{day,16h}$ where the difference between $L_{day,16h}$ and $L_{night,8h}$ ranged from 10 to 5 dB(A) *(114)*.

In the conversion formula given above, if the difference between day and night sound levels is of the order of 7–8 dB(A), then this accounts for approximately 2 dB(A) higher L_{den} values compared to $L_{day,16h}$. This is commonly found for road traffic noise in urban streets with the 24-hour noise levels tending to be only slightly lower than daytime levels *(118)*. A conversion factor of 2 dB(A) was also suggested based on Norwegian data (T. Gjestland, personal communication, 2006). Another study found the difference range $L_{den} - L_{dn}$ to be between 0 and 1.5 dB, depending on whether the noise level L_{Aeq} dropped in the evening *(119)*.

To summarize, because the differences between L_{den} and L_{dn} are usually small, in epidemiological studies in which the relative effects of road traffic noise are studied, sound emission during the daytime can be taken as an approximate relative measure of the overall sound emission, including at night. This is further justified by the fact that existing noise regulations usually accept a 10-dB(A) difference between the day and the night. However, this approximation can only be made with respect to road traffic noise. For train and aircraft noise, no such approximation can be made. Approximate formulae for the conversion of different noise indicators are also given in the *Good practice guide for strategic noise mapping (120)*.

Meta-analysis - road traffic noise and myocardial infarction

To determine the most up-to-date and accurate exposure–response relationship between community noise and myocardial infarction, a meta-analysis was carried out *(21,121)*. By 2005, a total of 61 epidemiological studies had been recognized as having either objectively or subjectively assessed the relationship between transportation noise and myocardial infarction. Nearly all of the studies referred to road traffic noise or (commercial) aircraft noise, and a few to military aircraft noise. Most of the studies were of the cross-sectional type (descriptive studies) but observational studies such as case-control and cohort studies (analytical studies) were also available. The study subjects were children and adults. Confounding factors were not always adequately considered in some older studies. Not many studies provided information on exposure–response relationships, because only two exposure categories were considered.

All epidemiological noise studies were evaluated with respect to their feasibility for inclusion in a meta-analysis. The following criteria for the inclusion in the analysis/synthesis process were applied: (*a*) peer-reviewed in the international literature; (*b*) reasonable control of possible confounding (stratification, model adjustment, matching); (*c*) objective assessment of exposure (sound level); (*d*) objective assessment of outcome (clinical assessment); (*e*) type of study (analytical or descriptive); and (*f*) multi-level exposure–response assessment (not only dichotomous exposure categories).

Based on the above criteria, five analytical (prospective case-control and cohort) and two descriptive (cross-sectional) studies were suitable for derivation of a common exposure–response curve for the association between road traffic noise and the risk of myocardial infarction. Two separate meta-analyses were undertaken by considering the analytical studies and descriptive studies separately. The analytical studies comprised those that were carried out in Caerphilly and Speedwell with a pooled analysis of 6 years follow-up data *(122,123)* and the three Berlin studies *(124,125)*. The descriptive studies comprised the cross-sectional analyses that were carried out on the studies in Caerphilly and Speedwell *(126)*. All studies referred to the road traffic noise level during the day ($L_{day,16h}$) and the incidence (analytical studies) or prevalence (descriptive studies) of myocardial infarction as the outcome. The study subjects were men. In all analytical studies the orientation of rooms (moderator of the exposure) was considered for the exposure assessment (at least one bedroom or living room facing the street or not). In all descriptive studies the traffic noise level referred to the nearest facades that were facing the street and did not consider the orientation of rooms/windows (source of exposure misclassification). The individual effect estimates of each study were adjusted for the covariates given in these studies. This means that different sets of covariates were considered in each study. Nevertheless, this pragmatic approach accounts best for possible confounding in each study and provides the most reliable effect estimates derived from each study.

The common set of covariates considered in the descriptive studies were age, sex (males only) social class, body mass index, smoking, family history of ischaemic heart disease, physical activity during leisure time and prevalence of pre-existing diseases. The common set of covariates considered in the analytical studies were age, sex (males only), social class, school education, employment status, shift work, smoking and body mass index. Some of the analytical studies also considered physical activity during leisure time, family history of ischaemic heart disease or myocardial infarction, prevalence of pre-existing diseases, work noise and marital status. In one study, the effect estimates were further adjusted for hypertension and diabetes mellitus. This may be a conservative approach owing to over-controlling, because these biological (risk) factors may be mediators along the pathway from exposure (noise stress) to disease.

The odds ratios calculated for the different 5-dB(A) noise categories ($L_{day,16h}$) within a single study were then pooled between studies for each noise category. Since higher exposure categories usually consist of smaller numbers of subjects than the lower categories, regression coefficients across the whole range of noise levels within a study tend to be largely influenced by the lower categories. This may lead to an underestimation of the risk in higher noise categories. The multi-level approach pooled the effect estimates of single studies within each noise category, thus giving more weight to the higher noise categories and accounting for possible non-linear associations.

The results from the two meta-analyses (descriptive studies and analytical studies) are shown in Table 2.1 *(121)*. For each meta-analysis we include the odds ratios (OR) and 95% confidence intervals (CI) for the original studies (with the weights used in the pooled analysis), the pooled OR and CI and the Laird Q-test of heterogeneity between studies. If the *P*-value from the Q-test is < 0.05, the studies are too heterogeneous and should not be combined.

The pooled estimates and CIs are shown graphically in Fig. 2.1 (descriptive studies) and Fig. 2.2 (analytical studies). The descriptive (cross-sectional) studies (Fig. 2.1) cover the sound level range of $L_{day,16h}$ from > 50 to 70 dB(A), while the cohort and case-control studies (Fig. 2.2) cover the range from ≤ 60 to 80 dB(A). The two curves together can serve as a basis for estimating the exposure–response relationship. From Fig. 2.1, it can be seen that below 60 dB(A) for $L_{day,16h}$ no noticeable increase in myocardial infarction risk is to be detected. For noise levels greater than 60 dB(A), the myocardial infarction risk increases (Fig. 2.1 and 2.2).

A polynomial function was fitted through the data points from the analytical studies (Fig. 2.2), to generate a continuous exposure–response curve that can be applied to categorized noise data and also to continuous noise data. The data points were weighted by the number of subjects (N-weighting) *(21,121)*. Mean category values of the decibel-axis are considered for the calculation. For the reference category "≤ 60 dB(A)", a value of 55 dB(A) was used because this category also includes a large number of noise levels below 55 dB(A). Using alternative values for this reference category (e.g. 52.5 or 57.5) had only a very marginal effect on the coefficients and the fit statistics. According to the empirical German noise assessment model (*Lärmbelastungsmodell*), daytime noise levels tend to be equally distributed across the categories > 45–50, > 50–55 and > 55–60 (127). In urban settings, background levels during the day do not often fall below 50 dB(A).

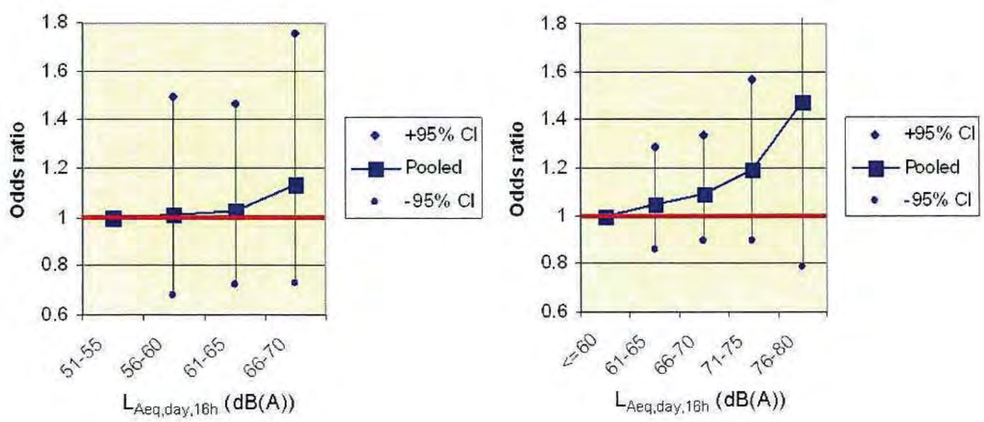
Table 2.1. Odds ratios and 95% confidence intervals from descriptive and analytical studies on the relationship between road traffic noise level and the incidence/prevalence of myocardial infarction

Descriptive studies	Road traffic noise level, $L_{day,16h}$ (dB(A))					N
	51–55	56–60	61–65	66–70		
Caerphilly	1.00	1.00 (0.58–1.71) [13.29]	0.90 (0.56–1.44) [17.23]	1.22 (0.63–2.35) [8.98]		2512
Speedwell	1.00	1.02 (0.57–1.83) [11.19]	1.22 (0.70–2.12) [12.62]	1.07 (0.59–1.94) [10.94]		2348
Pooled	1.00	1.01 (0.68–1.50)	1.02 (0.72–1.47)	1.14 (0.73–1.76)		
Q-test		$P = 0.96$	$P = 0.41$	$P = 0.77$		
Analytical studies	**< 60**	**61–65**	**66–70**	**71–75**	**76–80**	**N**
Caerphilly & Speedwell	1.00	0.65 (0.27–1.57) [4.95]	1.18 (0.74–1.89) [17.48]	—	—	3950
Berlin I	1.00	1.48 (0.57–3.85) [4.21]	1.19 (0.49–2.87) [4.94]	1.25 (0.41–3.81) [3.09]	1.76 (0.11–28.5) [0.50]	243
Berlin II	1.00	1.16 (0.82–1.65) [31.43]	0.94 (0.62–1.42) [22.76]	1.07 (0.68–1.68) [18.92]	1.46 (0.77–2.78) [9.27]	4035
Berlin III	1.00	1.01 (0.77–1.32) [54.42]	1.13 (0.86–1.49) [50.87]	1.27 (0.88–1.84) [28.24]	—	4115
Pooled	1.00	1.05 (0.86–1.29)	1.09 (0.90–1.34)	1.19 (0.90–1.57)	1.47 (0.79–2.76)	
Q-test		$P = 0.57$	$P = 0.87$	$P = 0.84$	$P = 0.90$	

Source: Babisch 2006 (121).

Note: Numbers are odds ratios; 95% confidence intervals are given in round brackets; weights are given in square brackets; N = sample size; Pooled = pooled estimates from meta-analysis of the studies shown; P = probability of the Q-test for heterogeneity.

Fig. 2.1 & 2.2. Pooled effect estimates (meta-analysis) of the association between road traffic noise and the prevalence (Fig. 2.1, left) and incidence (Fig. 2.2, right) of myocardial infarction (odds ratio +/- 95% confidence interval)



Source: Babisch (21).

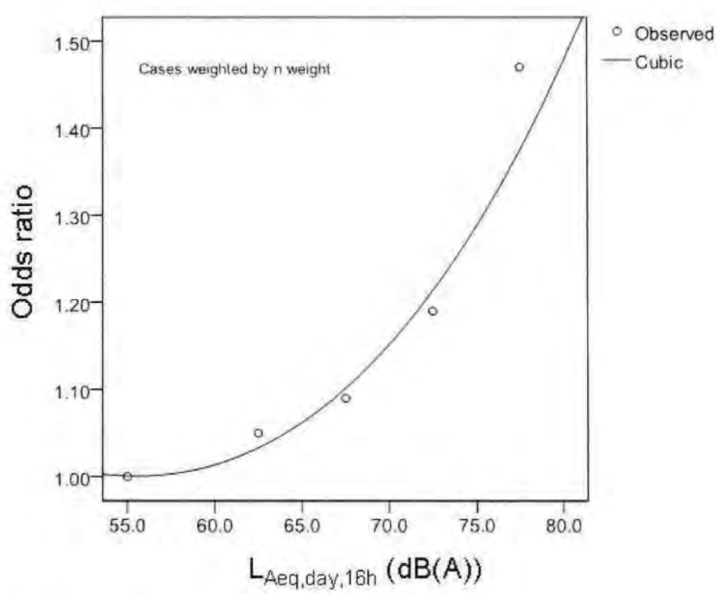
The result is shown graphically in Fig. 2.3 and mathematically below. This polynomial function explains 96% of the variance (R^2) in the meta-analytical results. Because of the data used to derive this function, the exposure–response function refers to road traffic noise and to the daytime noise indicator $L_{day,16h}$. It is defined for noise levels ranging from 55 to approximately 80 dB(A):

$$OR = 1.63 - 0.000613 \cdot (L_{day,16h})^2 + 0.00000736 \cdot (L_{day,16h})^3$$

The analytical studies were chosen for the risk curve because of their generally accepted higher credibility with respect to causal inference. However, when both descriptive and analytical studies were considered together for one polynomial fit, the results were almost identical. This exposure–effect curve will regularly be updated with respect to information from new studies. For practical application, the odds ratios for different noise levels are given in Appendix 1 to this chapter.

Alternatively, a fixed-effect meta-analysis of a linear trend was carried out *(21)*. It revealed an OR of 1.17 (95% CI 0.87–1.57, $P = 0.301$, $P(Q) = 0.943$).

Fig. 2.3. Polynomial fit of the exposure-response relationship for road traffic noise and the incidence of myocardial infarction



Source: Babisch (21).

Meta-analysis: road traffic noise and hypertension

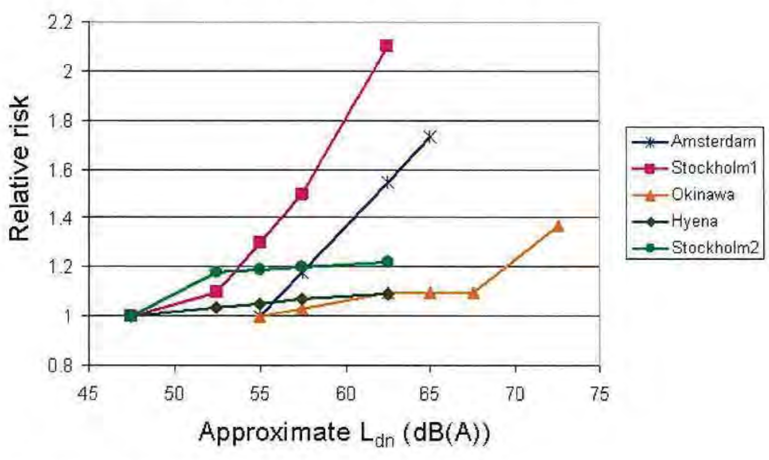
Regarding hypertension, a pooled estimate of the relative risk of 0.95 (95% CI 0.84–1.08) per 5-dB(A) increase in noise level during the day ($L_{day,16h}$ < 55–80 dB(A)) was calculated for the association between road traffic noise and hypertension based on a meta-analysis published in 2002 *(20)*. This estimate was recently updated based on new study results, and a pooled estimate of 1.12 (95% CI 0.97–1.30) was reported *(22)*. Significant results were found in two recently published studies, showing increases in the risk of hypertension of 1.05 (95% CI 1.00–1.10) per 5-

dB(A) increase in noise level (L_{24h} = 45–75 dB(A)) *(128)* and 1.38 (95% CI 1.06–1.80) per 5-dB(A) increase in the 24-hour noise level ($L_{24h} \approx$ 40–70 dB(A)) *(129)*, respectively. In a study looking at the combined effects of road traffic noise and air pollution on the prevalence of hypertension, the odds ratios for noise did not wane after adjustment for air pollution *(130)*.

Meta-analysis: aircraft noise and hypertension

The results of five studies on the relationship between aircraft noise and high blood pressure are shown in Fig. 2.4 *(128,131–135)*. The study subjects were men and women. A noise-level-related data pooling (categorical approach) was difficult to perform owing to the fact that different (national) exposure indices were used. Furthermore, different definitions of hypertension were applied. Individual odds ratios and confidence intervals were taken from summary reports and the original publications for this purpose to calculate regression coefficients of individual studies and odds ratios with respect to the weighted day/night noise indicator L_{dn}, which is supposed to be very similar to L_{den}. When the coefficients of a linear trend from the five studies were taken together ("regression approach"), the pooled estimate of the relative risk was 1.13 (95% CI 1.00–1.28) per 10 dB(A) for aircraft noise levels ranging between approximately 47 and 67 dB(A) *(136)*. The statistical test for heterogeneity of the studies was significant ($P(Q)$ = 0.002). However, fixed and random effect estimates were the same. Owing to the results of new studies, this pooled effect estimate was smaller than that obtained from an earlier meta-analysis where the estimate of the relative risk was 1.59 (95% CI 1.30–1.93) per 10-dB(A) increase in the noise level *(20)*.

Fig. 2.4. Association between aircraft noise and the prevalence or incidence of high blood pressure



Source: Babisch & Van Kamp (136).

Disability weight

Different values of DW are used in the WHO comparative risk assessment reports by the different categories of epidemiological subregion that were defined based on geographical location and the level of infant and adult mortality (7).

The DW for acute myocardial infarction in the WHO EUR-A epidemiological subregion[2] is 0.405 *(7)*. However, disability weights of 0.108 and 0.186 are given for angina pectoris and congestive heart failure. No DW is given for ischaemic heart disease as a group. Hypertensive heart disease for the EUR-A epidemiological subregion is 0.201 but no DW is given for hypertension alone. In the literature, however, disability weights of 0.350 and 0.352 are reported for ischaemic heart disease as a group and for hypertension, and one year was considered for the duration of ischaemic heart disease and hypertension *(137)*.

EBD calculations

Two examples are given for calculating EBD from noise for cardiovascular disease. First, the exposure-specific approach is used to estimate the DALYs from myocardial infarction due to road traffic noise in Germany. Second, different noise exposure prevalence data are used to estimate the attributable fraction of myocardial infarction due to noise in Berlin.

Exposure-based approach for road traffic noise and myocardial infarction in Germany

An example is given for Germany regarding road traffic noise and myocardial infarction. These EDB calculations use an exposure-based approach. The country-specific population-attributable fraction (impact fraction) and the attributable cases can be calculated based on the distribution of the population in different exposure categories and the respective relative incidence of disease. This approach requires:

- a population-based estimate of the prevalence of the outcome in Germany obtained from surveys or national statistics;
- an estimate of the attributable fraction of the outcome caused by environmental noise, calculated from German estimates of exposure prevalence and Fig. 2.3; and
- a value of DW for each case of the outcome caused by environmental noise.

Prevalence of noise exposure

According to the older German noise exposure model (*Lärmbelastungsmodell*), it was estimated (reference year 1999) that approximately 16% of the German population were exposed to road traffic noise levels (taken at the facades of their houses) exceeding 65 dB(A) during the day ($L_{day,16h}$), that some 15% were exposed to 60–65 dB(A) and that approximately 69% were exposed to levels below 60 dB(A) *(138)*. The noise distribution is shown in Table 2.2. During the night, noise levels tend to be 7–10 dB(A) lower.

Attributable fraction calculation

By applying the polynomial equation of the exposure–response function (Fig. 2.3) to the noise exposure distribution of the German population, it is possible to calculate an attributable fraction (AF) for each exposure group, that is, the proportion of cases of myocardial infarction due to noise exposure.

2 The WHO EUR-A epidemiological subregion comprises Andorra, Austria, Belgium, Croatia, Cyprus, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

The risk ratios attributed to the exposure categories are taken from Fig. 2.2. Using the formula of the population-attributable fraction (PAF) provides the following results:

$$PAF = \frac{(1.031 \cdot 0.153 + 1.099 \cdot 0.090 + 1.211 \cdot 0.051 + 1.372 \cdot 0.015 + 1 \cdot 0.691) - 1}{1.031 \cdot 0.153 + 1.099 \cdot 0.090 + 1.211 \cdot 0.051 + 1.372 \cdot 0.015 + 1 \cdot 0.691} = 0.0291$$

The resulting attributable fraction of myocardial infarction due to road traffic noise for the German population in the year 1999 is therefore 2.9%.

Table 2.2. Example: attributable fraction for myocardial infarction due to road traffic noise, estimated from the noise exposure pattern in Germany

Road traffic noise 1999, $L_{day,16h}$ (dB(A))	Percentage exposed	Relative risk	Attributable fraction
< 60	69.1	1.000	0.00
60–64	15.3	1.031	3.03
65–69	9.0	1.099	9.03
70–74	5.1	1.211	17.44
> 75	1.5	1.372	27.13

Cases of and deaths from myocardial infarction due to noise

According to the national health statistics, 849 557 cases of ischaemic heart diseases (ICD 9, No. 410–414), including 133 115 cases of acute myocardial infarction (ICD 9, No. 410), were diagnosed in 1999 *(139)*. The number of deaths due to myocardial infarction in Germany in 1999 was 76 961. So as not to double count cases when DALYs are calculated, the number of deaths was subtracted from the number of cases, leaving 56 154 new cases that did not result in death.

To calculate the cases due to traffic noise, the number of cases of myocardial infarction is multiplied by the attributable risk. Since there is no reason to believe that cases resulting in death should differ from those that do not with respect to noise exposure, the same attributable risk is applied to both groups of myocardial infarction cases.

The number of cases of non-fatal myocardial infarction (56 154) multiplied by 2.9% results in approximately 1629 new cases per year of non-fatal myocardial infarction in Germany attributable to traffic noise.

In addition, a proportion of deaths from myocardial infarction may also be attributable to traffic noise. Each of these deaths includes future YLL. Life expectancy at each age in 2002–2004 was used *(139)*. For each age group, the number of deaths due to myocardial infarction was multiplied by the life expectancy at that age separately for males and females. The total YLL for each sex was multiplied by 2.9% to give the YLL attributable to noise. This results in approximately 29 488 YLL.

Calculation of DALYs

To gain a rough estimate of the DALYs lost due to noise-related myocardial infarction for one year, the formulae in the previous chapter can be used:

DALY = YLL + YLD

where YLD = I · DW · L and YLL = number of deaths · average loss of life per death due to myocardial infarction.

Assuming one year of disability for each non-fatal case of myocardial infarction, the total DALYs are equal to:

29 488 + (1 629 · 0.405 · 1) = 30 147

This does not include ongoing morbidity after the first year.

Exposure-based approach for road traffic noise and myocardial infarction in Berlin

Another example, referring to the city of Berlin, is based on recent noise exposure data (L_{den} and L_{night}) derived from the strategic noise maps according to Directive 2002/49/EC *(113,140)*. The noise distribution is shown in Table 2.3 and it can be seen that the prevalences of exposure are lower than those in Table 2.2. Since Berlin is a metropolitan city where the noise exposure is likely to be higher than in smaller communities and rural areas, the data suggest that the traffic noise exposure in Germany, in general, is lower than estimated by the old *Lärmbelästigungsmodell (138)*. However, one has to consider that only the primary road network was assessed. On the other hand, traffic volumes of more than about 12 000 vehicles during the day (6:00–22:00) – corresponding to approximately L_{Aeq} = 65 dB(A) – are not very likely for the secondary road network. Applying the formula given above, the attributable fraction for Berlin is 0.0107, meaning that approximately 1.1% of all myocardial infarctions would be attributable to the road traffic noise in Berlin.

Table 2.3. Estimated road traffic noise exposure for the city of Berlin

Average sound pressure level, L_{den} (dB(A))	Number of citizens exposed [a]	Percentage exposed [b]	Relative risk of myocardial infarction [c]
Approx. < 55	2 683 449	80.53	1.000
> 55–59	220 200	6.61	1.000
60–64	155 000	4.65	1.015
65–69	140 200	4.21	1.067
70–74	112 600	3.38	1.161
> 75	20 800	0.62	1.302

[a] Numbers refer to the primary road network of Berlin.
[b] Total population of Berlin: 3 332 249 (2005).
[c] Odds ratios are derived from the polynomial risk equation for $L_{day,16h}$ = L_{den} - 2 dB(A).

Estimation of ischaemic heart disease burden from road traffic noise in the EU Member States

There is no international database on noise exposure of the European population covering the whole European Region. However, the Noise Observation and Information Service for Europe (NOISE) maintained by the European Environment Agency (EEA) and the European Topic Centre on Land Use and Spatial Information (ETC LUSI) on behalf of the European Commission provide noise exposure data that can be used for calculating disease burden in the western European countries. It contains data related to strategic noise maps delivered in accordance with EU Directive 2002/49/EC relating to the assessment and management of environmental noise (*141*). As for road traffic noise, the dataset covers the exposure distribution in approximately 20% of the total EU population as of January 2010. Bearing in mind that there are uncertainties and assumptions involved in using the exposure data based on strategic noise maps by the Member States (see below), we can use this official data to estimate burden of disease in the EU Member States.[3]

Table 2.4 summarizes the distribution of the population exposed to road traffic noise in agglomerations with more than 250 000 inhabitants, and relative risks and attributable fractions for respective exposure categories. The risk ratios attributed to different L_{den} categories are taken from Appendix 1 of this chapter. Applying the formula given above, the attributable fraction is 0.018, meaning that approximately 1.8% of all myocardial infarctions would be attributable to road traffic noise in these western European countries.

Table 2.4. Road traffic noise exposure for the European countries reporting noise maps

Road traffic noise within agglomeration L_{den} (dB(A))	Percentage exposed [a]	Relative risk [b]	Attributable fraction
< 55	50	1.000	0.00
55–59	17	1.000	0.00
60–64	19	1.015	1.48
65–69	9	1.067	6.29
70–74	4	1.161	13.87

Source: Noise Observation and Information Service for Europe (*141*).
[a] The population size is 110 million living in agglomerations with > 250 000 inhabitants.
[b] The risk ratios attributed to different L_{den} categories are taken from Appendix 1 of this chapter.

3 Austria, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

In 2008, WHO published an updated report on global burden of disease *(142)*. In this report, the DALYs for disease cluster categories were reported by different subregions based on income levels. High-income European countries[4] correspond to the EUR-A subregion with very low child and adult mortalities in the previous reports. DALYs of cardiovascular diseases are reported in the categories of rheumatic heart disease, hypertensive heart disease, ischaemic heart disease, cerebrovascular disease and inflammatory heart diseases. The total burden of ischaemic heart disease is 16 826 000 DALYs out of 883 million people in the WHO European Region, of which 3 376 000 DALYs are out of 407 million people in the high-income European countries. As DALYs for myocardial infarction were not published, we applied the above attributable fraction to the category of ischaemic heart disease. In other words, for the sake of DALY calculation, we assumed that road traffic noise has the similar impact on all ischaemic heart disease as on myocardial infarction. In high-income European countries, DALYs attributable to transport noise were estimated to be 60 768 years (1.8% of 3 376 000 DALYs) *(142)*.

Uncertainties, limitations and challenges

Biological plausibility of association

The biological plausibility of the hypothesis of noise effects is well-documented (see previous section summarizing the evidence). Acute noise effects have been studied extensively over the past 50 years, and a general noise reaction model was well-established before research moved from the laboratory to test hypotheses with respect to the long-term effects of noise in epidemiological studies.

The auditory system is continuously analysing acoustic information, which is filtered and interpreted by different cortical and sub-cortical brain structures causing acute responses of the autonomic nervous and the endocrine system, even during sleep. Long-term noise stress can adversely affect biological risk factors due to chronic dysregulation. Considering this pathway, noise must be viewed as an environmental risk factor. In epidemiological noise studies, higher risk estimates were found when length of exposure was considered (years in residence). The same accounts for room orientation and window opening habits (higher risks when rooms were facing the street with windows open). This is in accordance with the noise hypothesis and the effects of chronic noise stress (exposure effect).

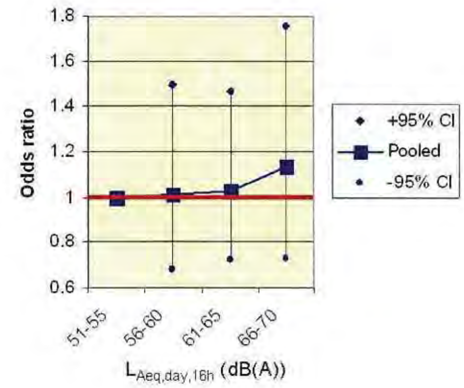
Generalization of myocardial infarction to other ischaemic heart diseases

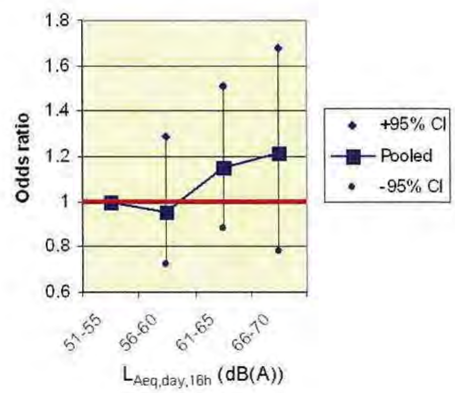
Myocardial infarction was considered for the meta-analysis because it was the outcome most commonly assessed in the studies that met the inclusion criteria for the review. The noise impact on myocardial infarction may have been easier to detect by epidemiological studies, because misclassification in the diagnosis of myocardial infarction is less likely than for all ischaemic heart diseases. Ischaemic heart disease comprises: acute myocardial infarction, other acute and sub-acute forms of ischaemic heart disease, old myocardial infarction, ischaemic signs in the electrocardiogram, angina pectoris, coronary atherosclerosis and chronic ischaemic heart disease.

4 High-income European countries are: Andorra, Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, the Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Because there is no exclusive causal mechanism postulated specifically for myocardial infarction, it has been suggested that the impact fraction of traffic noise could be applied to all types of ischaemic heart disease. Therefore, the exposure–response curve for myocardial infarction could be generalized to all ischaemic heart diseases for the calculation of DALYs. This is supported by Fig. 2.5 and Fig. 2.6, which shows the association between road traffic noise level during the day ($L_{day,16h}$) and the prevalence of myocardial infarction and ischaemic heart diseases based on two studies, where all detailed information was assessed within each study *(126)*. It can be seen that the associations with the noise level look quite similar. The point estimate of pooled effect estimates for noise levels higher than 60 dB(A) are slightly higher for (all) ischaemic heart diseases than for myocardial infarction.

Fig. 2.5 & 2.6. Exposure-response curve for road traffic noise and the prevalence of myocardial infarction (Fig. 2.5, left) and all ischaemic heart diseases (Fig. 2.6, right)





Source of the data: Babisch et al. 1993 *(126)*

Specificity of hypertension as an outcome

Pooling of data is difficult when different criteria and assessment methods for the disease end-points were used in different studies. For example, with respect to hypertension, some aircraft noise studies refer to the former WHO criterion of a measured blood pressure of 160/100 mmHg, while others refer to the current WHO criterion of 140/90 mmHg. Perhaps more importantly, different determinants of high blood pressure were used, including self-reported doctor-diagnosed hypertension, anti-hypertensive drug medication, actual blood pressure measurements, or combinations of the three. The heterogeneity of the studies may be less of a problem with respect to the slope of the pooled exposure–response curve. However, decisions must be made regarding the onset (threshold) of the increase in risk. For the calculation of the attributable fraction, estimates of different scenarios can be made.

Generalization of evidence to both sexes

The exposure–response curve derived from male study subjects was generalized to women. The subjects in the noise studies were mostly men, owing to considerations of statistical power in the study design. Cardiovascular diseases are more frequent in middle-aged males *(143)*. For reasons of homogeneity, the relatively small number of females was excluded from the calculation of the pooled effect estimates.

The available results of noise studies do not allow for a distinction between the sexes. There is some indication that males may be more affected by road traffic noise *(125,128,144,145)* but contradictory results have also been found *(129)*. Studies on the association between environmental noise and high blood pressure showed no consistent pattern with respect to higher relative risks in either men or women *(18)*. In studies where females were considered, the hormonal/menopausal status was not assessed, which could act as a confounder (falsely showing differences between the sexes) *(146)*.

In laboratory studies, the focus was primarily on "before-after" effects of noise exposure in the same test subjects rather than on gender differences. In occupational noise studies, gender was often considered as a confounding factor but not as a potentially effect-modifying factor in the statistical analyses. Male blue collar workers were predominantly found in high-noise workplaces. Studies on the association between environmental noise and high blood pressure showed no consistent pattern with respect to higher relative risks in either men or women *(121)*.

Although there are differences in the absolute risk between males and females, it seems reasonable to assume that, in relative terms, females may be just as affected by noise stress as males. Nevertheless, in future noise studies, potential gender differences should be addressed.

Issues of statistical significance

The confidence intervals of the effect estimates shown in Fig. 2.1 and 2.2 for the association between traffic noise and myocardial infarction include relative risks of 1.0. The purpose of the meta-analysis was to derive a "best guess" pooled relationship for the calculation of population-attributable risks. Individual studies showed significant ($P < 0.05$) or borderline significant ($P < 0.10$) results when the highest exposure categories were combined and/or subsets of subjects with long years in residence were considered *(124,125)*. When the meta-analysis is carried out for subsamples of subjects that had lived for at least 10 or 15 years in their dwellings, larger effect estimates were also obtained in the meta-analysis *(21)*. For example, when the upper two noise categories of the exposure–response curve are combined, the pooled effect estimate is OR = 1.25 ($P = 0.068$) in the total sample, and OR = 1.44 ($P = 0.020$) in the sub-sample, the latter being statistically significant. Regarding linear trend, the odds ratio in the sub-sample of subjects with many years of residence was 1.44 per 10-dB(A) increase in the noise level (CI 0.97–2.12, $P = 0.067$), which was borderline significant. However, for the calculation of population-attributable risk percentages, the weaker effect estimates were considered to apply to the entire study populations, because information about modifiers of exposure such as length of residence or window/room orientation will not be available for general populations. Depending on the results of new studies, the current risk curves must be regularly updated.

Lack of exposure data

The lack of accurate exposure data is a major hindrance in estimating actual burden of disease. How can exposure data from countries and subregions be obtained? EU Member States have just started to systematically assess the environmental noise due to road, rail and air traffic and commercial/industrial activities in their communities according to EU Directive 2002/49/EC *(113)*. The noise mapping data for Directive 2002/49/EC can be used as shown above. It should be noted that the application of the exposure data for the urban population to the total population in the EU may lead to overestimation of burden. To avoid this possibility, we extrapolated only to agglomerations with > 50 000 inhabitants (57% of the EU population). The accuracy and representativeness of exposure data will improve when the second round of noise mapping produce data from agglomerations with 100 000–250 000 inhabitants in 2012. Exposure data will be still sparse from the WHO EUR-B[5] and EUR-C[6] epidemiological subregions. Extrapolation of exposure data from EUR-A to the EUR-B and EUR-C epidemiological subregions might be problematic because the level of noise exposure of the population might be quite different between these subregions.

Road traffic is a key environmental noise source. However, results from epidemiological studies with respect to the association of other environmental noise sources (such as air traffic noise, railways or even leisure noise) with myocardial infarction are rarely available. For the time being, the exposure–response curve derived for road traffic noise could be used, considering that at the same average noise level, aircraft noise tends to be more annoying and conventional railway noise less annoying than road traffic noise *(119,147)*. Furthermore, exposure misclassification diluting the true effects is less of a problem with respect to aircraft noise because all sides of the house are equally exposed. (*Note.* According to Directive 2002/49/EC, noise levels refer to the most exposed side of a dwelling.) The characteristics of road traffic noise and its effects can be quite different from rail and aircraft noise, which is an additional source of uncertainty when applying road noise curves to other noise sources and vice versa.

Confounding with air pollution

Air pollutants have also been shown to be associated with cardiovascular end-points *(148–155)*. In real life, individuals exposed to road noise are also likely to be exposed to air pollution arising from road traffic. It is not yet clear whether the impact of noise on ischaemic heart disease is independent, additive or synergistic to the impact of outdoor air pollution. Air pollution studies have not controlled for noise and vice versa. Air pollution epidemiology carried out in the last century focused primarily on respiratory illness, which was not an issue in noise research. However, cardiopulmonary mortality was also identified as a key outcome of acute and chronic exposure to air pollutants.

Most information on hospital admissions due to acute changes (increases) in levels of air pollutants come from time-series studies *(150)*. Studies on short-term exposure to elevated concentrations of fine particulate matter are associated with acute changes in cardiopulmonary health. However, since traffic volume does not show

5 The WHO EUR-B epidemiological subregion comprises Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Montenegro, Poland, Romania, Serbia, Slovakia, Tajikistan, the former Yugoslav Republic of Macedonia, Turkey, Turkmenistan and Uzbekistan.

6 The WHO EUR-C epidemiological subregion comprises Belarus, Estonia, Hungary, Kazakhstan, Larvia, 6Lithuania, the Republic of Moldova, the Russian Federation and Ukraine.

considerable day-to-day variations, the changes in air pollution in these studies are due to other factors that affect the concentration of air pollutants, mainly changes in weather conditions. Noise levels in urban environments, on the other hand, are primarily determined by the relatively constant traffic volume per day, and much less by weather conditions when the distance of houses from the street is short (urban noise). In this respect, confounding between noise and air pollution is not likely with respect to short-term effects in time-series studies.

The health effects of noise in general refer to long-term chronic noise stress. Confounding can be an issue in long-term effects observed by cross-sectional, case-control and cohort studies. Epidemiological studies have shown strong associations of mortality and life expectancy with long-term exposure to fine particulate matter and sulfates *(156)*. However, the study designs of cohort studies on the association between air pollutants and cardiopulmonary mortality differ considerably from those of noise exposure. In air pollution studies, the spatial exposure is often considered on an ecological basis. Subjects from different metropolitan areas with different mean (background) concentrations of air pollutants have been compared with respect to disease occurrence. No distinction is usually made between busy streets and side streets *(148,149,152,157)*. In noise studies, the exposure in front of a study participant's house was assessed on an individual level with respect to nearby sound sources, along with individual confounding factors. Differences of 1:100 (20 dB(A)) in terms of sound intensity are common for people living in different streets or even only a few yards away from one another, because shielding is highly effective for noise. The sound level can diminish from the front to the back of a house by 30 dB(A) or more (sound intensity 1:1000). To some extent, one could say that major air pollution studies refer to macro-scale exposures while noise studies refer to micro-scale exposures.

Further, cardiovascular effects of noise (hypertension) were also found for noise sources where air pollutants are less likely to be co-varying factors, e.g. occupational noise *(20)* and aircraft noise *(121)*. It was shown that the relative contribution of airport operations to the emission levels of nitrogen oxides, carbon monoxide, sulfur dioxide, volatile organic compounds and black smoke was small compared to the background concentrations in the vicinity of an airport *(158)*. In spite of this obvious co-exposure, there was a lack of interaction between the scientific community dealing with the health impacts of noise and that dealing with air pollution. However, this has changed in recent years and studies on their combined effects are currently under way *(130,159,160)*. Some studies have used the distance to major roads as a surrogate for exposure to air pollutants. However, noise would be as good an explanation for the observed effects *(161–165)*.

Method of calculating the exposure–response relationship

Different approaches have been used to calculate pooled effect estimates and exposure–response relationships. These include the "regression approach" and the "categorical approach". In the regression approach, the slopes (regression coefficients) across all noise categories of each noise study are pooled to assess a common regression coefficient. In the categorical approach, the relative risks found for the same noise category in each noise study are pooled and considered for the calculation of an exposure–response curve. The regression approach has the advantage that regression coefficients can be pooled regardless of actual noise levels; only the slope (regression coefficient) of the exposure–response relationship is taken into account. The categorical approach is noise-level oriented. Possible thresholds of effects can be determined, and it is less likely to obscure possible non-linear associations, but it requires comparable exposure indicators of the studies considered in the meta-analysis. Often both, trend and categorical contrast analyses are carried out simultaneously (128).

Conclusions

The noise indicators used for noise mapping in the EU can – in principle – be used for a quantitative risk assessment regarding cardiovascular risk if exposure–response relationships are known. Only two end-points – hypertension and ischaemic heart disease – should be considered at this stage. If necessary, different exposure–response curves could be used for different exposures. Some studies showed that associations between noise level and cardiovascular outcomes were stronger with respect to noise exposure at night *(128,166,167)*. In this respect, it can be useful to consider different exposure–response relationships for day and night noise, particularly if the exposed side of the house is considered for exposure assessment. For practical reasons, attempts should be made to reduce the set of necessary exposure–response curves to a minimum. The noise indicator L_{den} may be useful for assessing and predicting annoyance in the population. However, non-weighted day and night noise indicators may be more appropriate for health-effect-related research and risk quantification. It is a matter for future research to determine how the integrated noise indicator L_{den} performs in noise studies, particularly with respect to noise sources (railways, aircraft) other than road traffic where the differences between day and night noise are less uniform and depend on location and other circumstances (e. g. night noise regulations).

We adopted conservative assumptions whenever necessary. One exception was to extrapolate the exposure data from urban population to the whole population of the EU. This was necessary because of a lack of exposure data for the rural population as of 2010. Considering the advanced level of urbanization in western Europe and the bias toward the null in the estimation of relative risks due to random misclassification of exposure, the overall impact of overestimation due to extrapolation might be minimal. Nevertheless, it is desirable to use exposure data for the whole population when it is available.

We have to learn to live with uncertainties *(168,169)*. Nevertheless, "no exposure data" does not mean "no exposure" and "no scientific evidence" does not mean "no effect" *(170)*. Using the precautionary principle, decisions can be made based on best available data *(171,172)*. Future epidemiological noise research will need to focus on vulnerable groups, effect modifiers, sensitive hours of the day, coping mechanisms, differences between noise sources, possible confounding with air pollution, differences between objective (noise level) and subjective (noise perception) exposure, and multiple exposures (home, work and leisure environments).

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Appendix 1. Exposure-response curve (polynomial fit) of the association between road traffic noise and incidence of myocardial infarction

$$OR = 1.629657 - 0.000613 \cdot (L_{day,16h})^2 + 0.000007357 \cdot (L_{day,16h})^3$$

$L_{day,16h}$	L_{den}*	OR	$L_{day,16h}$	L_{den}*	OR
55	57	1	67.5	69.5	1.099
55.5	57.5	1	68	70	1.108
56	58	1	68.5	70.5	1.118
56.5	58.5	1	69	71	1.128
57	59	1	69.5	71.5	1.138
57.5	59.5	1.002	70	72	1.149
58	60	1.003	70.5	72.5	1.161
58.5	60.5	1.005	71	73	1.173
59	61	1.007	71.5	73.5	1.185
59.5	61.5	1.009	72	74	1.198
60	62	1.012	72.5	74.5	1.211
60.5	62.5	1.015	73	75	1.225
61	63	1.019	73.5	75.5	1.239
61.5	63.5	1.022	74	76	1.254
62	64	1.027	74.5	76.5	1.269
62.5	64.5	1.031	75	77	1.285
63	65	1.036	75.5	77.5	1.302
63.5	65.5	1.042	76	78	1.318
64	66	1.047	76.5	78.5	1.336
64.5	66.5	1.054	77	79	1.354
65	67	1.06	77.5	79.5	1.372
65.5	67.5	1.067	78	80	1.391
66	68	1.074	78.5	80.5	1.411
66.5	68.5	1.082	79	81	1.431
67	69	1.091	79.5	81.5	1.452
			80	82	1.473

*Approximation: $L_{den} = L_{Aeq,16h} + 2$ dB

3. ENVIRONMENTAL NOISE AND COGNITIVE IMPAIRMENT IN CHILDREN

Staffan Hygge
Rokho Kim

It has been suspected for many years that children's learning and memory are negatively affected by noise. Over 20 studies have shown negative effects of noise on reading and memory in children *(1,2)*: epidemiological studies report effects of chronic noise exposure and experimental studies report acute noise exposure. Tasks affected are those involving central processing and language, such as reading comprehension, memory and attention *(3–6)*. Exposure during critical periods of learning at school could potentially impair development and have a lifelong effect on educational attainment.

Evidence from recent well-controlled epidemiological studies with representative samples of children has also made it possible to start to quantify the magnitude of noise-induced impairment on children's cognition and identify the relative contribution of different sources of noise. Children may be exposed to noise for many of their childhood years and the consequences of long-term noise exposure on reading comprehension and further cognitive development remain unknown. Such quantifications, albeit initially crude, will in the long run help to estimate and quantify how much cognitive development individual children could be expected to lose because of noise, and the economic impact of this for learning in schools. In turn, such estimates will be also of value for making projections on the societal level, including political decision about any sociodemographic redistribution of noise exposure. On the other hand, exposure–response curves can also be used for social engineering decisions about how much of an improvement, and for whom, can be expected from a reduction in noise levels.

This chapter attempts to contribute to this general goal by placing the negative effects of noise on children's cognition into the risk assessment context.

Definition of outcome

Cognitive impairment is not an outcome of a clinical diagnosis; it is therefore not possible to derive a conventional exposure–risk relationship suitable for calculating burden of disease. Lopez et al. *(7)* defined cognitive impairment as "delayed psychomotor development and impaired performance in language skills, motor skills, and coordination equivalent to a 5- to 10-point deficit in IQ". Contemporaneous cognitive deficit is defined as "reduction in cognitive ability in school-age children, which occurs only while infection persists".

These definitions are not helpful and not readily applicable to the studies reported on noise and cognition in children. None of the studies has explicitly employed IQ as an end-point and the confining of any reduction in cognitive ability to the duration of the noise exposure is too restrictive. Therefore, our case definition of noise related cognitive impairment is:

> Reduction in cognitive ability in school-age children that occurs while the noise exposure persists and will persist for some time after the cessation of the noise exposure.

A notable characteristic of this definition is that the cognitive impairment is assumed to show itself during the noise exposure as well as some time after the exposure has stopped.

Summary of evidence linking noise and cognitive impairment in children

The extent to which noise impairs cognition, particularly in children, has been studied with both experimental and epidemiological designs. The epidemiological studies report effects of chronic noise exposure and the experimental studies of acute noise exposure. The studies relevant to children's cognition are not many and do not always meet strict methodological criteria. Nevertheless, there are three recent studies that meet basic methodological quality criteria and are also comparable with each other in terms of the cognitive functions measured.

One of the most compelling studies in this field is the naturally occurring longitudinal quasi-experiment reported by Evans and colleagues, examining the effect of the relocation of Munich airport on children's (9–10 years, N = 326) health and cognition *(8–10)*. In 1992, the old Munich airport closed and was relocated. Prior to relocation, high noise exposure was associated with deficits in long-term memory and reading comprehension. Two years after the closure of the airport, these deficits disappeared, indicating that effects of noise on cognition may be reversible if exposure ceases. Most convincing was the finding that deficits in the very same memory and reading comprehension tasks developed over a two-year follow-up in children who became newly exposed to noise near the new airport.

The recent large-scale RANCH study, which compared the effect of road traffic and aircraft noise on children's (9–10 years, N = 2844) cognitive performance in the Netherlands, Spain and the United Kingdom, found a linear exposure–effect relationship between long-term exposure to aircraft noise and impaired reading comprehension and recognition memory, after taking a range of socioeconomic and confounding factors into account *(11)*. No associations were observed between long-term road traffic noise exposure and cognition, with the exception of episodic memory, which surprisingly showed better performance in high road traffic noise areas. Neither aircraft noise nor road traffic noise affected attention or working memory.

A study of ambient noise exposure (predominantly road and rail sources) of fourth-grade children living in the Tyrol mountain region compared three cognitive measures for schoolchildren (mean age 9–7 years, N = 123) exposed to 46 or 62 dB(A) L_{dn}. The two sociodemographically homogeneous samples differed only in their noise exposure range (M = 46.1 L_{dn} vs M = 62 L_{dn}). Long-term noise exposure was significantly related to both intentional and incidental memory. The improvement in cognitive performance in the quieter group was estimated at 0.5% (recall prose and recognition) to 1% (free recall) per dB. The authors note that the magnitude of the effects shown was smaller than those uncovered in earlier airport noise studies.

Both the RANCH and Tyrol studies indicate that aircraft noise may be worse for cognition than road traffic noise. For aircraft noise, exposure evidence from the Munich study seems to indicate that L_{Aeq} = 60 may be a dividing line, but the RANCH study results suggest more of a linear association between aircraft noise exposure and impairment of reading comprehension. For ambient road and rail noise, the Tyrol study suggests that effects occur around L_{dn} = 60.

Other field studies of children have had some methodological limitations, which make them less relevant as evidence. For example, the testing of cognitive capacities took place in noisy conditions for the noise-exposed and in quieter conditions for the children in the control groups. Testing in silent conditions would have been preferred, in order to compare the noise effect on memory and learning between exposure and control groups *(12–16)*. Also, for some studies, the sociodemographic variables and different reading curricula between the schools were not fully adjusted or controlled for.

Experimental studies of the impact of acute noise exposure on reading and memorizing new material are generally not as vulnerable to selection biases as epidemiological studies. Memory tests are made in silence of material that was read in noise. Participants are randomized to exposure and control groups, and children are sampled from sociodemographically comparable schools. To a certain extent, there is comparability between the memory and reading tests employed in the experimental studies and the field studies (the Munich and RANCH studies), even though the field studies concern chronic noise exposure and the second set acute noise exposure.

Exposure-response relationship

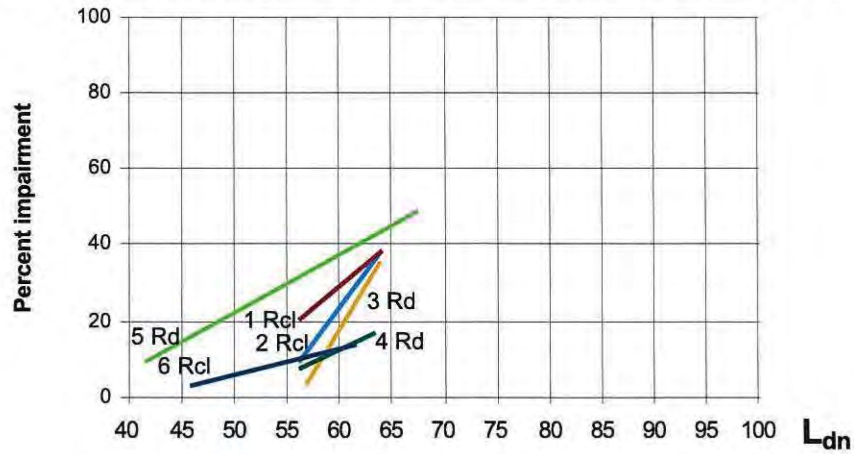
Only the Tyrol study *(17)* has used the noise indicator L_{dn}. The Munich study used $L_{eq,24h}$ and the RANCH study predominantly used $L_{eq,16h}$. The L_{dn} and L_{eq} metrics are not directly equivalent: L_{dn} is always equal to or larger than L_{eq}, with the following differences between L_{dn} and L_{eq} (T. Gjestland, personal communication, 2006):

- evenly distributed traffic flow, + 6.4 dB
- evenly distributed 07:00–22:00, no night traffic, + 1.9 dB
- 10% of traffic during 22:00–07:00, + 2.9 dB.

Although it is not clear which noise metric is the most adequate, L_{dn} may be more appropriate for the measurement of noise effects on cognition for some specific noise sources. For example, for aircraft noise exposure, the RANCH study found that both school $L_{eq,16h}$ and home $L_{eq,8h}$ (so a comparison of daytime noise exposure at school and nighttime noise exposure at home) had a similar detrimental effect on reading comprehension scores. These findings suggest that a measure such as L_{dn}, which combines daytime and nighttime exposure, would be appropriate for examining the effects of aircraft noise on cognition. However, this issue may be more complicated for other noise sources. For cognition, the fact that children spend the daytime at school and the nighttime at home needs to be taken into consideration. Aircraft noise exposure at school and home were highly correlated in the RANCH study, which could account for the similar effect on cognition for the daytime and nighttime measures. Road traffic noise at home and school were less highly correlated, suggesting that exposure measures that cover the 24-hour period may be less reliable in detecting cognitive effects and could be associated with error.

Fig. 3.1 shows the exposure–response curves from the different epidemiological studies. This can be summarized in quantitative terms: for the field studies in Fig. 3.1, memory recall and reading have average slopes of around 2% per L_{dn}, as calculated by the mean of the slopes of the six lines. Thus, for recall and reading, it is expected that a reduction of the chronic noise level by 5 L_{dn} would result in improved performance by 10%. As noted above, the only available road traffic noise study *(17)* had a less steep slope. The fact that we do not have much data from road traffic noise exposure set a limit to the generality of our conclusion, but the results of studies on aircraft noise, albeit few, are nevertheless consistent.

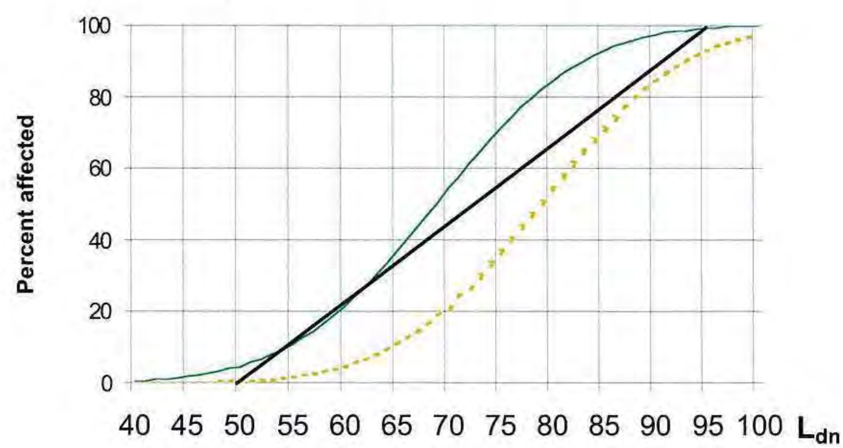
Fig. 3.1. Exposure-response curves from different epidemiological studies



Notes. Rd = reading; Rcl = memory, recall
1 = recall, children, old airport *(10)*.
2 = recall, children, new airport *(10)*.
3 = reading, children, old airport *(10)*.
4 = reading, children, new airport *(10)*.
5 = reading, children *(11)*.
6 = free recall, children *(17)*.

To obtain the exposure–response relationship, we need to use the information above to determine an approximate curve. Assuming that 100% of those exposed to noise are cognitively affected at the very high noise levels, e.g. 95 L_{dn}, and that none are affected at a safely low level, e.g. 50 L_{dn}, a straight line (linear accumulation) connecting these two points, as in Fig. 3.2, can be used a basis for approximations. This straight line is an underestimation of the real effect, since for theoretical reasons based on an (assumed) underlying normal distribution, the true curve should have the same sigmoidal function form as the two curves in Fig. 3.2. Within the noise exposure bracket 55–65 L_{dn}, the straight line and the solid line sigmoidal distribution agree on approximately 20% impairment. In the bracket 65–75 L_{dn}, the number should be in the range of 45–50% and above 75 L_{dn} in the range of 70–85%.

Fig. 3.2. Hypothetical exposure-risk curves and estimated percentage of affected people



Disability weight

Lopez et al. *(7)* suggested DWs for different cognitive impairments ranging from 0.468 (e.g. Japanese encephalitis) or 0.024 (e.g. as a result of iron deficiency anaemia). Contemporaneous cognitive deficit was given a DW of 0.006. Thus, this is a very conservative choice to go with the definition of contemporaneous cognitive deficit and a DW of 0.006 in estimates of the noise-related impairment of children's cognition.

There would be no mortality due to cognitive impairment, so estimation of YLD per year will be sufficient to estimate the total DALYs.

EBD calculations

Two examples are given. First, the exposure-specific approach is used to calculate the burden of disease from cognitive impairment due to noise in children aged 7–19 years in Sweden. And second, the values estimated in the first example are extrapolated to all of the WHO EUR-A epidemiological subregion *(7)*.

Note that the calculations rest on the assumption that the noise effects are there only when people are exposed. There is no assumption made that the inflicted noise-induced disability lasts longer than the noise exposure. It would not be unreasonable to set a case also for lasting cognitive effects of noise after the cessation of exposure, but that has explicitly not been done here.

Exposure-specific approach to environmental noise and cognitive impairment in Swedish children

For the first example, the exposure-specific approach is used to calculate the burden of cognitive impairment due to environmental noise in children aged 7–19 in Sweden. This approach requires:

- the distribution of the prevalence of exposure to environmental noise within the population from EU data;
- the exposure–response relationship between noise and the outcome from Table 3.1; and
- a value of DW for each case of the outcome caused by environmental noise.

Prevalence of noise exposure

There are no relevant figures for how many children are exposed to different noise levels. What are available are estimates of the percentage of people exposed to noise at different levels in the EU. For instance, Roovers et al. *(18)* stated that around 68% are exposed to L_{dn} levels < 55, 19% to 55–65, 11% to 65–75 and 2% to > 75. This is shown in Table 3.1, although statistics for the specific countries within geographical regions such as the EU may vary *(19)*.

The noise exposure distribution shown in Table 3.1 is for adults, but there is no reason to believe that the exposure distribution for children is very different. If there is a difference in noise exposure levels, children are more likely than adults to be exposed to noise.

To calculate the number of children exposed to the noise levels that meet the criterion of cognitive impairment, the age distribution in the population must be considered. In Sweden, 23.9% of the population are aged under 20 years and 16.53% were in the age range of the mandatory school system in 2004. In 2004, there were 1 489 437 school-aged children in Sweden. It can be noted that the proportion of the population up to 19 years (23.95%) fits closely with the 24.2% for the EU in 1998 *(19)*.

Table 3.1. Percentage of the population exposed to various levels of noise (L_{dn}) and calculated number of exposed children aged 7–19 years

Noise level (L_{dn})	Population exposed	Number of children exposed
< 55	68%	1 012 817
55–65	19%	282 993
65–75	11%	163 838
> 75	2%	29 789
Total	100%	1 489 437

Source: Roovers et al. *(18)*.

Number of cases of and YLD from cognitive impairment caused by environmental noise

Combining the number of children exposed (Table 3.1) with the likelihood of cognitive impairment if exposed (Fig. 3.2), the number of children with noise-induced cognitive impairment can be calculated. To estimate YLD due to the cognitive impairment, this number is multiplied by the DW of 0.006 (Table 3.2).

Table 3.2. Estimated number of children aged 7–19 years in Sweden with noise-induced cognitive impairment and DALYs per year due to noise-induced cognitive impairment (NICI)

Age group and noise exposure level	No. of children aged 7–19 exposed	Percentage of children who will develop NICI	No. of children with NICI	DALYs lost for NICI
7–19 years, < 55 L_{dn}	1 012 817	0	0	0.0
7–19 years, 55–65 L_{dn}	282 993	20	56 599	339.6
7–19 years, 65–75 L_{dn}	163 838	50	81 919	491.5
7–19 years, > 75 L_{dn}	29 789	75	22 342	134.1
Total	1 489 437		160 859	965.2

According to our estimates, there are 160 859 Swedish children aged 7–19 (point prevalence) who could be cognitively impaired to the extent of DW 0.006. This can also be considered equivalent to 160 859 years lived with this disability in 2004. This amounts to 965 YLD for noise-induced cognitive impairment in Swedish children aged 7–19 years. This estimate is based on the conservative assumption that noise effects on cognitive impairment and childhood learning are temporary.

Exposure-specific approach for environmental noise and cognitive impairment in children in the EUR-A epidemiological subregion

The noise exposure figures in Table 3.1 were taken to be representative for Europe, and the distribution of children aged 7–19 years of age in Sweden is close to that reported for Europe as a whole. Therefore, the number of DALYs per million children aged 7–19 in the EUR-A countries can be calculated (Table 3.3). The absolute DALY for the EUR-A countries, with an estimated total population of 420 503 million, is therefore 45 036.

Table 3.3. Estimated DALYs per year per million children aged 7–19 in the EUR-A epidemiological subregion

Age group and noise exposure level	Percentage of population exposed to noise level	Percentage of population who will develop cognitive impairment	Number impaired per million	DALYs lost per million
7–19 years, < 55 L_{dn}	11.24	0	0	0.0
7–19 years, 55–65 L_{dn}	3.14	20	6 281	37.7
7–19 years, 65–75 L_{dn}	1.82	50	9 090	54.5
7–19 years, > 75 L_{dn}	0.33	75	2 475	14.9
All other age groups	83.47	0	0	0.0
Total	100.00		17 846	107.1

Uncertainties, limitations and challenges

Source of noise

The slopes reported in Fig. 3.1 are for aircraft noise only. In contrast to the Munich study, which focused on aircraft noise, the RANCH study also included road traffic noise. But for road traffic noise, there was no indication of a significant impairment of children's cognition. As an explanation, the authors pointed out that aircraft noise, because of its intensity, the location of the source, and its variability and unpredictability, is likely to have a greater effect on children's reading than road traffic noise, which might be of a more constant intensity. Thus, it is conceivable that aircraft noise is more damaging than road traffic noise for children's cognition. This may also be true when the L_{dn} level is controlled for, which has been reported for children's memory in an experimental acute noise study *(20)*.

Even though there may be a degree of difference between aircraft and road traffic noise, acting on the safety principle would suggest treating them as equally damaging to children's cognition and to assume that there is approximately the same response effect regardless of noise source. This may, however, tend to overestimate the effects of road traffic noise.

Design of epidemiological studies

It should be noted that the RANCH study was a cross-sectional study in contrast to the prospective, longitudinal Munich study. This may make the Munich study more powerful in picking up unconfounded cause–effect relationships between noise exposure and outcomes.

Possibility of long-term cognitive impairment from chronic noise exposure

The DALYs calculated in Table 3.2 have not taken into account any lasting or longstanding impairment of cognitive functioning that could occur as a result of long-term noise exposure. Our calculations are restricted to the period in children's life when they attend primary school, assuming that the impacts of noise are negligible on the cognitive function of adults. This assumption is very conservative, however, because it is more likely that children who have passed through the mandatory school system in a noisy environment would live with a long-term consequence of cognitive impairment. They are also more likely to live in a noisy environment even after the schooling period, which is more likely for children who go to school in areas exposed to aircraft noise. It would be realistic to assume that the impaired cognitive function will carry over to the years after the schooling period. If future studies provide an estimation of the severity and the duration of such chronic effect of noise on cognitive function, the calculation of DALYs should be updated.

Assumption of the duration of the impact

There is some evidence from the Munich study *(10)* that after the cessation of exposure to aircraft noise, children (age 9–11 years) recover within 18 months to the cognitive performance levels of their year-mates who were not exposed to much aircraft noise. Thus, it is possible that, at least for young children, chronic noise effects are reversible and that the DWs will diminish with increasing age. However, we assumed in our calculation that the effects are temporary and recovery is quicker, yielding YLD values that are conservative.

Assumption of the exposure-risk relationship

As pointed out above, with reference to the linear and sigmoidal accumulation of effects in Fig. 3.2, we have most likely not overestimated the fractions of children affected in the noise exposure ranges 65–75 L_{dn} (50%) and > 75 L_{dn} (75%). Further, we might have underestimated the average DW (0.006) for those affected by the higher level of noise. These two conservative assumptions may have led to a significant underestimation of the real DALYs in the EUR-A epidemiological subregion given in Table 3.3. For example, if DW doubles and quadruples to 0.012 and 0.0024 in the exposure brackets 65–75 L_{dn} and > 75 L_{dn}, respectively, the DALYs will be much greater than shown in Table 3.3.

Policy considerations

An alternative to viewing the noise-induced cognitive impairment of children from a burden-of-disease perspective is to analyse the impairment in terms of wasted learning units. The learning units could be given a monetary value in wasted teaching hours in schools – wasted for the teachers, the pupils and society. Therefore, the societal impact will probably be larger than the impact reflected by DALYs, which solely estimate the impact on specific cognitive impairment. A calculation of wasted learning units instead of DALYs is probably a more complicated task, with many more uncertain parameters. For the time being, DALYs from noise-induced impairment of cognition in children, together with DALYs from other environmental risks, may provide evidence for prioritizing policy options, such as lowering recommended noise levels in control guidelines for schools and learning.

Conclusions

Reliable evidence indicates the adverse effects of chronic noise exposure on children's cognition. There is no generally accepted criterion for quantification of the degree of cognitive impairment into a DW. However, it is possible to make a conservative estimate of loss in DALYs using the methods presented in this chapter. It is important to consider the assumptions, uncertainties and limitations in the methods when interpreting the estimated values of EBD.

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4. ENVIRONMENTAL NOISE AND SLEEP DISTURBANCE

Sabine Janssen
Mathias Basner
Barbara Griefahn
Henk Miedema
Rokho Kim

Sleep disturbance is one of the most common complaints raised by noise-exposed populations, and it can have a major impact on health and quality of life. Studies have shown that noise affects sleep in terms of immediate effects (e.g. arousal responses, sleep stage changes, awakenings, body movements, total wake time, autonomic responses), after-effects (e.g. sleepiness, daytime performance, cognitive function deterioration) and long-term effects (e.g. self-reported chronic sleep disturbance).

Sufficient undisturbed sleep is necessary to maintain performance during the day as well as for general good health *(1)*. The human organism recognizes, evaluates and reacts to environmental sounds even while asleep *(2)*. These reactions are part of an integral activation process of the organism and express themselves as, for example, changes in sleep structure or increases in heart rate. Although they are natural (and even necessary) reactions to noise, it is assumed that a substantial increase in the number of such effects constitutes a health issue. Environmental noise may reduce the restorative power of sleep by means of repeatedly occurring activations (so-called sleep fragmentation). Acute and chronic sleep restriction or fragmentation has been shown to affect, among other things, waking psychomotor performance *(3)*, memory consolidation *(4)*, creativity *(5)*, risk-taking behaviour *(6)*, signal detection performance *(7)* and risks of accidents *(8,9)*.

There is an ample number of laboratory and field studies that provide sufficient evidence to conclude that traffic noise causally and relevantly disturbs sleep and, depending on noise levels, may impair behaviour and well-being during the subsequent period awake *(10–22)*. Although clinical sleep disorders (e.g. obstructive sleep apnoea, which is a sleep disorder characterized by pauses in breathing during sleep) have been shown to be associated with increased risks for cardiovascular disease, little is known about the long-term effects of noise-disturbed sleep on health. However, recent epidemiological studies do suggest that nocturnal exposure to traffic noise increases the risk of cardiovascular disease *(23–25)*.

In this chapter, available exposure–response relationships for various sleep disturbance indicators are discussed. Subsequently, a method for estimating the burden of self-reported sleep disturbance due to noise is proposed and illustrated.

Definition of outcome

Sleep disturbances can be measured electrophysiologically, using so-called polysomnography (PSG), or with self-reporting in epidemiological studies using survey questionnaires. PSG, i.e. the simultaneous recording of the electroencephalogram (EEG), the electrooculogram (EOG), the electromyogram (EMG) and other physiological variables, remains the gold standard for measuring and evaluating sleep. According to specific conventions *(26,27)*, the night is usually divided into 30-second epochs. Depending on EEG frequency and amplitude, specific patterns in the EEG, muscle tone in the EMG and the occurrence of slow or rapid eye movements in the EOG, different stages of sleep are assigned to each epoch. Wake, superficial sleep stages S1 and S2, deep sleep stages S3 and S4, and REM (rapid eye movement) sleep are differentiated. Current knowledge assumes that sleep stages differ in their function and in their relevance for sleep recuperation, where continuous periods of deep sleep and REM sleep seem to be especially important for sleep recuperation *(4)*. Shorter activations in the EEG and EMG, so-called arousals, can also be detected with polysomnography *(26,28)*. These arousals are usually accompanied by activations of the autonomic nervous system (e.g. increases in heart rate and blood pressure) and they may contribute to sleep fragmentation *(29,30)*. Further, motility (i.e. body movement during sleep) has been found to be a relatively easy to use and sensitive measure for sleep disturbance, and has been shown to be a predictor of effects such as awakening and self-reported sleep quality *(22)*. Depending on their frequency, acute noise effects on sleep (arousals, awakenings, body movements) cause a general elevation of the organism's arousal level that consequently leads to a redistribution of time spent in the different sleep stages, with an increase of the amounts of wake and stage S1 and a decrease of slow wave sleep (SWS) and REM sleep *(16,31–33)*.

In epidemiological studies, "self-reported sleep disturbance" is the most easily measurable outcome indicator, because physiological measurements are costly and difficult to carry out on large samples and may themselves influence sleep. However, since during most of the night the sleeper is not aware of himself or his surroundings, the process of falling asleep and longer wake periods during the night contribute disproportionately to subjective estimates of sleep quality and quantity, which may therefore differ substantially from objective measures *(34)*. Nevertheless, self-reported sleep disturbance may have validity in its own right by reflecting the impact on sleep as perceived by the subject over a longer period of time.

In surveys asking about sleep disturbance, responses can be graded on a scale from 0 to 100. On this scale, similar to definitions of noise annoyance, cut-off values were chosen of 50 and 72 to determine the percentage of people sleep-disturbed and highly sleep-disturbed by transportation noise, respectively *(35)*. In the case study included in this chapter, high sleep disturbance is used as the sleep disturbance indicator. Using a lower cut-off value (i.e. sleep-disturbed) would give higher prevalence but would be associated with a lower DW, resulting in either a higher or a lower estimate of the burden caused by sleep disturbance due to noise. An important reason for using high sleep disturbance is that this is closer to the case definition used in studies associating a DW to sleep disturbance based on the comparison to other health states (see below).

Noise exposure

Appropriate exposure indicator

In the position paper on dose–effect relationships for nighttime noise *(36)*, as well as in the EU's Directive 2002/49/EC *(37)*, L_{night} was proposed as the nighttime noise indicator for sleep disturbances (see Chapter 1). L_{night} is defined as the "A-weighted long-term average sound level as defined in ISO 1996-2: 1987", determined over all night periods of a typical year. Noise events in the period between 23:00 and 7:00 contribute to the calculation of L_{night}. In WHO's *Night noise guidelines for Europe (38)*, several $L_{night,outside}$ exposure categories are linked with sufficient scientific evidence to health and sleep disturbance outcomes, and can accordingly be used to assess the degree of sleep disturbance associated with transportation noise (see Table 4.1). Additionally, it is possible to derive exposure–response relationships between L_{night} and instantaneous reactions to noise (such as the number of additionally induced EEG awakenings or behaviourally confirmed awakenings) to assess the expected degree of sleep fragmentation. However, L_{night} is an equivalent continuous sound pressure level summarizing complex time patterns of exposure into a single value. This necessarily leads to information loss: noise scenarios, which differ in number, acoustical properties and placement of noise events, may calculate to the same L_{night} but differ substantially in their effects on sleep. In contrast to daytime traffic, where high traffic densities may lead to more or less constant and continuous noise levels, low traffic densities during the night often go along with intermittent exposure to single noise events. Hence, traffic-noise-induced alterations in sleep structure depend crucially on the number of noise events, the acoustical properties (such as maximum sound pressure levels) of single noise events, the placement of noise events within the night, and noise-free intervals between noise events *(11,19,39)*. Indeed, the *Night noise guidelines for Europe (38)* still support the validity of the recommendation of the WHO *Guidelines for community noise (40)* that, in order to prevent sleep disturbances, one should consider the equivalent sound pressure level and the number and level of sound events. Also, Directive 2002/49/EC *(37)* states that it may be advantageous to use maximum sound pressure level L_{Amax} or sound exposure levels as supplementary noise indicators for night period protection. However, predicting after-effects such as self-reported sleep disturbance or long-term health effects may require information on the long-term average sound level.

Exposure data for estimating the burden of sleep disturbance due to noise

Since road traffic noise accounts for the larger proportion of people exposed in most European countries (based on data from France, the Netherlands, Switzerland and the United Kingdom), road traffic noise exposure data are chosen here to estimate the burden of disease. As an example, exposure data from the Netherlands are used (Table 4.2). The exposure assessment was based on most exposed facade at dwellings, not on individuals. The total population was 15.864 million in the Netherlands in 2000. Assuming that household size does not differ between the noise exposure categories, these data may be extrapolated to the whole population. It should be noted that, because of the method of calculation used (25-metre grid), the higher levels tend to be underestimated.

Table 4.1. Ranges for the relationship between nocturnal noise exposure and health effects in the population

$L_{night,outside}$	Health effects observed in the population
< 30 dB(A)	Although individual sensitivities and circumstances differ, it appears that up to this level no substantial biological effects are observed.
30 – 40 dB(A)	A number of effects are observed to increase: body movements, awakenings, self-reported sleep disturbance and arousals. The intensity of the effect depends on the nature of the source and the number of events. Vulnerable groups (for example, children and chronically ill and elderly people) are more susceptible. However, even in the worst cases, the effects seem modest.
40 – 55 dB(A)	Adverse health effects are observed among the exposed population. Many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.
> 55 dB(A)	The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, and a sizable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases.

Source: Night noise guidelines for Europe (38).
Note. The guidelines assume an average attenuation of 21 dB(A) between inside and outside noise levels.

Table 4.2. Percentage of dwellings per environmental noise class in the Netherlands, 2000

L_{night} levels dB(A)- source	<39	40–44	45–49	50–54	>54
Motorways	70.2	16.2	9.1	3.1	1.4
Regional roads	93.8	3.4	1.6	0.8	0.3
City roads	57.9	17.7	15.2	8.0	1.3
All roads	21.9	37.3	25.9	11.9	3.0
Railways	76.6	12.4	6.3	2.7	1.9
Amsterdam Airport	98.1	1.4	0.5	0.0	0.0
All types of traffic	18.6	24.7	31.3	18.6	6.8

Source: Unpublished data from the Netherlands National Institute for Public Health and the Environment (RIVM), method described in Dassen AGM, Jabben J, Janssen PMH. [*Development of the environmental model for population annoyance and risk analysis. Partial validation and risk analysis.*] (abstract in English). Bilthoven, RIVM, 2001 (RIVM report 2001 725401001/2001).

Exposure-response relationship

Exposure-response relationships from experimental and field studies

Experimental and field studies have shown clear exposure–response relationships between single noise events and instantaneous arousals, EEG awakenings, behavioural awakenings or motility *(12,14,19,22,38,42–44)*. Exposure–response relationships between L_{night} or similar integrated measures and instantaneous sleep disturbance are rare *(45,46)*. This may in part be attributed to the fact that L_{night} as a whole-night indicator can only be directly related to whole-night sleep parameters. In principle, exposure–response relationships on the single event level can be used to predict the expected degree of sleep fragmentation depending on L_{night}, given the fact that the number and loudness of noise events are positively correlated with L_{night}. However, the variance in the number of noise-induced awakenings, and therefore the imprecision of the prediction, increases with increasing L_{night}, as many different exposure patterns can lead to the same L_{night} in the higher exposure categories. Therefore, it may be advantageous for assessing sleep disturbance to gather information on the number of noise events contributing to L_{night} additional to L_{night}.

Although instantaneous effects such as arousals, EEG awakenings, behavioural awakenings and elevated motility all reflect relevant aspects of the complex concept of sleep disturbance, it is not clear how they could be used to assess the burden of disease. Their occurrence is not pathological per se, as these reactions are also a physiological part of sleep in the absence of noise-induced sleep disturbance. They only reach pathological significance once a certain physiological frequency is exceeded, i.e. once sleep fragmentation reaches a relevant degree. However, interindividual variability in the sensitivity to noise exposure is high, and it is not clear to what extent the exposure–response relationships that were derived from field study subject samples with limited representativeness can be extrapolated to the population. Furthermore, although new research is under way, at the moment relationships are almost exclusively available for aircraft noise, whereas an assessment of the burden of sleep disturbance due to noise requires an assessment of the risk of other main sources as well.

Exposure–response relationships from epidemiological studies

Miedema et al. *(47)* presented synthesis curves for self-reported sleep disturbance from aircraft, road traffic and railway noise. These curves were based on the pooled data from 15 original data sets (more than 12 000 individual observations) obtained from 12 field studies (*a*) where L_{night} was included in the dataset or there was the possibility to calculate/estimate this metric on the basis of information regarding the included sites; and (*b*) where questions regarding waking up or being disturbed by transportation noise during the night were answered. Studies using questions that included disturbance of rest were excluded because resting is different from sleeping and does not necessarily take place during the night only. A more extensive analysis was recently completed *(35)*. It was based partly on the same data but included pooled data from 28 original data sets obtained from 24 field studies (23 000 participants) carried out since 1970. This analysis yielded very similar curves and included 95% confidence intervals that took into account the variation between individuals and studies.. However, no polynomial approximations were published for these curves, and therefore the functions from Miedema et al. *(47)* were used for the present purpose. The percentage of "highly sleep-disturbed" persons (%HSD) as a function of noise exposure indicated by L_{night} was found to be as follows.

Aircraft: $\% \text{ HSD} = 18.147 - 0.956\,(L_{night}) + 0.01482(L_{night})^2$

Road traffic: $\% \text{ HSD} = 20.8 - 1.05\,(L_{night}) + 0.01486(L_{night})^2$

Railways: $\% \text{ HSD} = 11.3 - 0.55\,(L_{night}) + 0.00759\,(L_{night})^2$

The curves are based on data in the L_{night} (outside, maximally exposed facade) range 45–65 dB(A). Low exposure levels ($L_{night} < 45$ dB(A)) were excluded from the analyses because the assessment of those noise levels was relatively inaccurate and other sources may be more important in situations with these low levels. High exposure levels ($L_{night} > 65$ dB(A)) were also excluded, because in the areas of very high exposure levels there may also have been self-selection of persons with low sensitivity to noise. Therefore, the extrapolation of the presented functions is expected to give a better indication of sleep disturbance at low and very high levels than using the data at these levels. The polynomial functions are close approximations of the curves in this range and their extrapolations to lower exposure (40–45 dB(A)) and higher exposure (65–70 dB(A)).

Although cumulative effects of simultaneous exposure to noise from different types of traffic should ideally be taken into account, knowledge on the effects of simultaneous exposure to different noise sources is limited *(48)*. A pragmatic way would be to calculate a single L_{night} value for all modes of transportation and base the risk assessment on this combined exposure measure, or preferably to use the methodology established earlier for determining the relationship between exposure to multiple noise sources and annoyance *(49)*.

Disability weight

The WHO DW for primary insomnia is 0.100 and is defined *(50)* as:

> *... difficulty falling asleep, remaining asleep, or receiving restorative sleep for a period [of] no less than one month. This disturbance in sleep must cause significant distress or impairment in social, occupational, or other important functions and does not appear exclusively during the course of another mental or medical disorder or during the use of alcohol, medication, or other substances.*

This definition of primary insomnia excludes the sleep disturbances that appear during the use of "other substances" or outside factors such as light or noise. When sleep is permanently disturbed by environmental factors and becomes a sleep disorder, it is classified in the International Classification of Sleep Disorders *(51)* as "environmental sleep disorder". Environmental sleep disorder (of which noise-induced sleep disturbance is an example) is a sleep disturbance due to a disturbing environmental factor that causes a complaint of either insomnia or daytime fatigue and somnolence *(38)*. While noise-induced sleep disturbance is not to be considered as a case of primary insomnia, the "burden of disease" of primary insomnia and noise-induced environmental sleep disorder may be similar. Van Kempen, cited in Knol & Staatsen *(41)*, reported a mean DW of 0.100 for severe sleep disturbance due to noise, based on a pilot study among 13 medical experts working according to a protocol by Stouthard *(52)*. De Hollander *(58)* expanded the study to 35 environmental physicians, epidemiologists and public health professionals and also found a mean DW of 0.10 (median DW: 0.08; standard deviation: 0.10; range: 0–0.45) using the same protocol. Although an earlier study published by de Hollander et al. *(53)* used a DW of only 0.010 for the same condition, no DW was available at that time so the weight of the least severe category of the first GBD study by Murray et al. *(59)* was used.

Müller-Wenk *(54)* found a mean DW of 0.055 (median DW: 0.04; range: 0.02–0.31) for those highly sleep-disturbed by nighttime road noise, based on a survey of 42 Swiss physicians who were asked to interpolate this type of sleep disturbance into a list of health states with existing DWs. In 2005, Knoblauch &

Müller-Wenk *(55)* interviewed a sample of 14 general practitioners recently admitting patients with obstructive sleep apnoea syndrome (OSAS) to the sleep clinic in St Gallen in Switzerland. They were asked to compare the relative mean severity of the health state of contacted persons with OSAS, with primary insomnia or with sleep disturbance due to increased exposure to road noise in the bedroom. This case definition of sleep disturbance is comparable to that of "highly sleep disturbed" on which the exposure–response relationship was based. Based on their own professional experience, 9 of the 14 respondents considered noise-related sleep disturbance to be less serious on average than primary insomnia, and 11 of the 14 considered noise-related sleep disturbance to be less serious on average than OSAS; the mean judgement of the 14 respondents was that noise-related sleep disturbance has a mean severity of 0.9 times the severity of primary insomnia (range: 0–2.1), which resulted in a DW of 0.09 (CI 0.06–0.12). As in the previous studies, the distribution was rather skewed; the median severity ratio was 0.63, which corresponds to a DW of 0.063.

Following the *Night noise guidelines for Europe (38)*, 0.07 was chosen as the DW of noise-related sleep disturbance in the calculation of DALYs. This value takes into account both the medians and the means of the DW observed in the above studies. Given the rather skewed distributions of the reported DWs, the median of the study with the lowest DW *(54)* was chosen as a low estimate, whereas the highest observed mean value *(41,58)* was chosen as a high estimate, yielding the uncertainty interval (0.04–0.10). The uncertainty in the exposure–response relationship was not factored in for this analysis.

EBD calculations

This section provides methodological guidance to two approaches to calculating the burden of sleep disturbance related to environmental noise. The first method is the exposure-based approach using the exposure–response relationship and exposure data. The second method is the direct estimation of the burden using a population survey.

Exposure-based assessment

The exposure-based approach estimates the prevalence of high sleep disturbance (reporting 72 or higher on a 100-point scale) due to noise by combining the exposure data with the exposure–response relationships for high sleep disturbance. One year of nighttime exposure to road traffic noise is proposed as the duration causing high sleep disturbance, since people with a bedroom exposed to a road with a high level of night traffic are subject to more or less stationary noise levels at night. Therefore, it can be assumed that their sleep disturbance exists all year round.

DALYs for sleep disturbance were calculated using the road traffic noise exposure distribution in L_{night} as assessed in the Netherlands in 2000 (see Table 4.2), the total population of the Netherlands in 2000 (15 864 000), the exposure–response relationships presented above for sleep disturbance due to road traffic noise (using the expected percentage of highly sleep-disturbed people at the midpoint of the category as a function of L_{night} in the range 45–65 dB(A)) and the DWs (see Table 4.3). This calculation suggests that there are about 24 669 DALYs lost in the Netherlands due to road traffic noise-induced sleep disturbance. Taking 0.04 and 0.10 as the extremes of the range for the weights, the credible range for the DALYs is from 14 096 to 35 242. This is a very conservative estimate, derived only for the exposure–response and exposure data for road traffic noise and not including the impacts of aircraft and railway noise. However, although the impact at a given exposure level is expected to be higher for aircraft noise (but slightly lower for railway noise) *(35)*, far fewer people are exposed to aircraft (and railway) noise than to road traffic noise.

Table 4.3. Exposure-based approach to estimating DALYs for highly sleep-disturbed people due to environmental noise, using exposure data from the Netherlands

Exposure category L_{night} (dB(A))	Percentage of population exposed	Percentage of people highly sleep-disturbed	Number of cases in the Netherlands	DALYs		
				DW = 0.04	DW = 0.07	DW = 0.10
45 – 49	25.9	4.3	176 677	7 068	12 367	17 668
50 – 54	11.9	6.4	121 009	4 840	8 471	12 101
>54	3.0	11.5	54 730	2 188	3 831	5 473
Total				14 096	24 669	35 242

Source: Unpublished data from the Netherlands National Institute for Public Health and the Environment (RIVM), method described in Dassen AGM, Jabben J, Janssen PMH. [*Development of the environmental model for population annoyance and risk analysis. Partial validation and risk analysis.*] (abstract in English). Bilthoven, RIVM, 2001 (RIVM report 2001 725401001/2001).

Burden of sleep disturbance from road traffic noise in western Europe

As mentioned in Chapter 2, the Noise Observation and Information Service for Europe (NOISE) provides noise exposure data that can be used for calculating disease burden in western European countries. Following the same method used in Chapter 2, the percentage of people highly sleep-disturbed can be calculating using the mid-level values of the exposure categories in the NOISE dataset. Because the NOISE dataset does not provide data on the categories of < 45 dB(A) and 45–49 dB(A), the percentages for these two categories were calculated conservatively by assuming the same percentages between the two categories of 45–49 dB(A) and 50–54 dB(A). The mid-level value of the category was used in the application of exposure–response functions specific to the noise sources. Because the L_{night} was the annual average of exposure level by definition, the duration of effects was also considered to be one year.

Tables 4.4, 4.5 and 4.6 summarize the distribution of population exposed to road, rail and air traffic noise, respectively, during the night in agglomerations with more than 250 000 inhabitants, and exposure-based DALY calculation using the exposure–response function presented above. Owing to a lack of exposure data covering the rural population, it was not possible to estimate DALYs for the whole EU population including rural areas without extrapolation. Assuming that the observed exposure distributions using the strategic noise maps may apply to approximately 285 million people living in cities or agglomerations with more than 50 000 inhabitants (57% of the total EU population), we can cautiously infer that the DALYs are approximately 903 000 years for urban population in the EU assuming DW = 0.07 (Table 4.7). Taking 0.04 and 0.10 as the extremes of the range for DWs, the credible range for the DALYs is 0.52–1.29 million. It should be noted that the burden in rural areas or small town with less than 50 000 inhabitants is not included here, and that we did not count the burden in the exposure range below 45 dB(A).

Table 4.4. DALYs for highly sleep-disturbed people due to road traffic noise in the EU

Exposure category L_{night} (dB(A))	Percentage of population exposed [a]	Percentage of people highly sleep-disturbed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.04	DW = 0.07	DW = 0.10
< 45	44[d]	NA	NA	NA	NA	NA
45–49	20[d]	4.5	8 906	101 526	177 670	253 814
50–54	20	6.6	13 266	151 230	264 652	378 074
55–59	10	9.6	9 556	108 937	190 640	272 342
60–64	5	13.2	6 611	75 365	131 888	188 412
65–69	1	17.6	1 763	20 099	35 174	50 248
Total	100		40 102	457 156	800 023	1 142 890

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.
[b] The percentage and number of cases were calculated with the polynomial equation, using the mid-level values of exposure categories.
[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.
[d] Noise maps do not provide data for the categories of < 45 dB(A) and 45–49 dB(A) for L_{night}. Therefore, the percentages of population in these categories were interpolated using a very conservative assumption: the percentage for the 45–49 dB(A) is the same as that for 50–54 dB(A).

Table 4.5. DALYs for highly sleep-disturbed people due to rail traffic noise in the EU

Exposure category L_{night} (dB(A))	Percentage of population exposed[a]	Percentage of people highly sleep-disturbed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.04	DW = 0.07	DW = 0.10
< 45	93[d]	NA	NA	NA	NA	NA
45–49	3[d]	2.3	690	7 866	13 765	19 664
50–54	3	3.3	1 003	11 440	20 019	28 599
55–59	1	4.8	477	5 437	9 515	13 593
60–64	0	6.6	0	0	0	0
65–69	0	8.8	0	0	0	0
Total	100		2 170	24 743	43 300	61 857

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.
[b] The percentage and number of cases were calculated with the polynomial equation, using the mid-level values of exposure categories.
[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.
[d] Noise maps do not provide data for the categories of < 45 dB(A) and 45–49 dB(A) for L_{night}. Therefore, the percentages of population in these categories were interpolated using a very conservative assumption: the percentage for the 45–49 dB(A) is the same as that for 50–54 dB(A).

Table 4.6. DALYs for highly sleep-disturbed people due to air traffic noise in the EU

Exposure category L_{night} (dB(A))	Percentage of population exposed[a]	Percentage of people highly sleep-disturbed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.04	DW = 0.07	DW = 0.10
<45	96[d]	NA	NA	NA	NA	NA
45–49	2[d]	6.2	1 235	14 078	24 637	35 195
50–54	2	8.8	1 761	20 075	35 130	50 186
55–59	0	12.2	0	0	0	0
60–64	0	16.3	0	0	0	0
65–69	0	21.1	0	0	0	0
Total	100		2 996	34 153	59 767	85 382

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.
[b] The percentage and number of cases were calculated with the polynomial equation, using the mid-level values of exposure categories.
[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.
[d] Noise maps do not provide data for the categories of < 45 dB(A) and 45–49 dB(A) for L_{night}. Therefore, the percentages of population in these categories were interpolated using a very conservative assumption: the percentage for the 45–49 dB(A) is the same as that for 50–54 dB(A).

Table 4.7. DALYs for highly sleep-disturbed people due to all traffic noise in the EU

Source of traffic noise	DALYs[a]		
	DW = 0.04	DW = 0.07	DW = 0.10
Road	457 156	800 023	1 142 890
Rail	24 743	43 300	61 857
Air	34 153	59 767	85 382

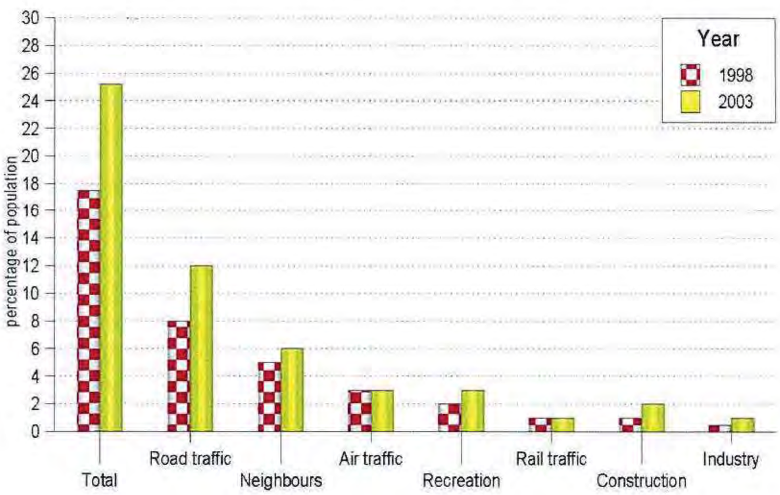
[a] For the 285 million population living in agglomerations with > 50 000 inhabitants.

Outcome-based assessment

The burden of highly disturbed sleep due to nighttime noise in terms of DALYs may also be directly estimated on the basis of survey data in the population concerned. Survey data from the Netherlands were used as an example in this section. Fig. 4.1 shows the relative contributions to overall sleep disturbance caused by noise from different sources in the Netherlands. These data were derived from surveys in 1998 and 2003 *(56)* in which 4000 and 2000 people, respectively, all of whom were randomly selected, were asked: "To what extent is your sleep disturbed by noise from (source mentioned) ...?" on a scale from 0 to 10 (pertains to noise perceived in the last 12 months). People recording the three highest points on the scale were considered "highly disturbed" according to an international convention that is close to the case definition used in the pooled analysis to define the exposure–response relationship *(46)*. About 12% of the general population reported being highly disturbed by road traffic noise during sleep in the Netherlands in 2003. The totals are calculated from the number of people reporting serious sleep disturbance from one or more sources. About 25% of the general population reported being highly disturbed by any source of noise during sleep in the previous 12 months. This approach allows cases from multiple sources to be counted more directly. Since this study is based on a survey conducted in the Netherlands, it is not representative of other Member States in the EU.

Considering that the Netherlands had a population of 16 225 000 in 2003, approximately 1 947 000 and 4 056 250 people were highly disturbed during sleep by road traffic noise and any source of noise, respectively. The corresponding DALYs calculated with a DW of 0.07 are 136 290 years and 283 937 years for road traffic noise and any source of noise, respectively (Table 4.8). The uncertainty in the survey estimates was not factored in for this analysis.

Fig. 4.1. Percentages of the population claiming to be highly disturbed by noise during sleep from two surveys in the Netherlands



Source: van den Berg et al. *(36)*.

Table 4.8. The estimated DALYs lost due to sleep disturbance using prevalence data from the Netherlands

Noise source	Percentage of population highly sleep disturbed	Population of the Netherlands	Number of cases in the Netherlands	DALYs		
				DW = 0.04	DW = 0.07	DW = 0.10
Road traffic	12	16 225 000	1 947 000	77 880	136 290	194 700
One or more sources	25	16 225 000	4 056 250	162 104	283 937	405 625

Uncertainties, limitations and challenges

Comparing two approaches

The DALYs based on the second method are significantly greater than those based on the exposure-based estimates. One of the reasons for the difference may be that the exposure–response relationship is not given for values below 45 dB(A) and above 65 dB(A), where the uncertainties of the relationship are greater. By not counting the people in the exposure range below 45 dB(A), the prevalence of sleep disturbance is underestimated. In addition, the percentage of sleep disturbed above the level of 65 dB(A) may be underestimated, also resulting in an underestimation of the burden of sleep disturbance induced by road traffic noise. This could partly be solved by extrapolating the exposure–response relationship for the range between 40 and 70 dB(A), should exposure data be available in this range.

Uncertainty with respect to the exposure-response relationship

The amount of variance in sleep disturbance scores explained by the exposure–response relationships is intermediate (road traffic, railways) or at the low end within the range of usual values that are considered meaningful (aircraft), so that they are not suited to predicting individual reactions. However, in most cases the uncertainty regarding individual reactions is not what matters for noise policy. Most policy, including policy based on estimates of the burden of disease due to environmental noise, is made with a view to the overall reaction to exposures in a (reference) population. This means that it is not the uncertainty with respect to the prediction of an individual or group reaction that is important, but that regarding the exact relationship between exposure and response in the (reference) population. The accuracy of the estimation of this relationship is described by the confidence intervals around the curve. If properly established, the confidence interval takes into account the variation between individuals as well as the variation between studies *(57)*, which are much smaller than the wide prediction intervals for individuals. The functions can be useful for evaluating the nighttime noise exposure in a particular area by predicting what the response of the reference population would be in that area.

With regard to aircraft noise, it should be noted that the variance in the responses is large compared to the variance found for rail and road traffic, meaning that the uncertainty is higher. One of the reasons for higher uncertainty may be that the time pattern of noise exposures around different airports varies considerably due to specific nighttime regulations. Also, there are indications of a time trend, whereby the most recent studies show the highest self-reported sleep disturbance, leading to a possible underestimation of the response at a given aircraft noise exposure level by the current curve.

Applications and limitations of the exposure-response relationship

According to the EU position paper on dose–effect relationships for nighttime noise *(36)*, the exposure–response relationships above represent the current best estimates of the influences of nocturnal traffic noise exposure (conceptualized as L_{night}) on self-reported sleep disturbance for road traffic and for rail traffic, when no other factors are taken into account. As mentioned above, the uncertainty may be higher with respect to aircraft noise, and such responses should be considered as indicative only.

A limitation of the exposure–response relationship is that it does not take into account other (exposure) variables that determine, in addition to average nighttime noise levels outdoors at the most exposed facade, the exposure level in the bedroom. Most important may be the difference in exposure between the most exposed facade and the bedroom facade, as well as the difference between the outdoor exposure at the bedroom facade and the indoor exposure in the bedroom. Also, adding noise exposure descriptors other than the nighttime average, such as noise in the early or late parts of the night, descriptors of peak levels or number of events may improve the prediction of self-reported sleep disturbance.

Also, it must be stressed again that the sleeper is not aware of himself or his surroundings during most parts of the night, and hence subjective estimates of noise-induced sleep disturbance may differ substantially from objective measures. Indeed, recent laboratory studies indicate that the impact of traffic noise on sleep structure increases in the order air road rail, thus reversing the order observed for self-reported measures such annoyance and sleep disturbance *(19,48)*. Therefore, although the estimated DALYs may correctly reflect the burden of disease in terms of self-reported sleep disturbance, it is questionable whether the estimates correctly reflect aspects that would reflect consequences of chronically fragmented sleep in terms of impairment of daytime performance or long-term health effects that are not obtainable via self-reporting.

Conclusions

Although self-reported sleep disturbance may not reflect the total impact of nighttime noise on sleep, it is the only effect for which exposure–response relationships on the basis of L_{night} are available for the most important noise sources. Furthermore, while it is hard to weigh self-reported sleep disturbance, it may be even harder to assign a DW to physiological changes indicating a certain degree of sleep fragmentation.

An example using data from 2000 on exposure in the Netherlands indicates a conservative estimate of some 25 000 DALYs lost yearly due to sleep disturbance induced by road traffic noise.

With the increasing effort devoted to noise mapping, more and better data on the levels of exposure to nighttime noise will become available in the EU Member States, so that, by combining them with the relationships, the prevalence of self-reported sleep disturbance can be estimated. Our calculation using the noise maps data showed that DALYs assuming DW = 0.07 were 307 959 years for the EU population living in agglomerations with > 250 000 inhabitants. Cautious extrapolation indicated that DALYs assuming DW = 0.07 might be in the range 0.5–1.0 million years for whole EU population.

We adopted conservative assumptions whenever necessary except for extrapolation of exposure data from larger agglomerations to the population of the agglomerations with > 50 000 inhabitants in the EU Member States. Considering that we did not count cases of high sleep disturbance occurring below 45 dB(A) and milder sleep disturbance at all ranges, we are confident that the above DALY estimation is not an overestimation.

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5. ENVIRONMENTAL NOISE AND TINNITUS[7,8]

Pierre Deshaies
Zilma Gonzales
Hans-Peter Zenner
Stefan Plontke
Louise Paré
Sylvie Hébert
Nicole Normandin
Serge-André Girard
Tony Leroux
Richard Tyler
Claudia Côté

Several authors consider tinnitus to be a symptom of the auditory system and not as a disease per se. On the other hand, tinnitus is an entry in the International Classification of Diseases (ICD-9 (388.3) and ICD-10 (H93.1)). Tinnitus is very often found to be present concomitantly with hearing loss. This is also true for noise-induced tinnitus and noise-induced hearing loss (NIHL) *(1,2)*. Nevertheless, tinnitus may be experienced by persons exposed to excessive noise without measurable hearing loss *(3)*. The natural history, the annoyance and disability, the clinical approaches for diagnosis and treatment and the consequences of tinnitus differ significantly from these elements in persons with NIHL. For instance, insomnia reported by tinnitus sufferers is not a consequence of NIHL. Therefore, the authors consider it justified that tinnitus be analysed per se as an independent outcome of environmental noise risk assessment and burden of disease.

Definition of outcome

Tinnitus is the general term for sound perception (for instance, roaring, hissing or ringing) that cannot be attributed to an external sound source. To put it in terms of auditory abilities, tinnitus is the inability to perceive silence *(4)*. Tinnitus defined in such broad terms is rather prevalent. It is widely believed that mild, occasional or acute temporary tinnitus is experienced by nearly everybody in their lifetime at some time or another, the majority resolving spontaneously *(5)*. There is considerable variation in tinnitus expression, its etiology and its effects on patient's lives *(6)*.

Tinnitus may be classified according to its different attributes: duration of a single episode (seconds, minutes; intermittent, continuous), temporal duration (days, months, years) or severity (degree of annoyance, interference with daily living). Dauman & Tyler *(7)* proposed a classification according to five parameters of tinnitus: pathology, severity, duration, site and etiology. Stephens & Hétu *(8)* proposed a clas-

7 This chapter is dedicated to the late Xavier Bonnefoy, who was an essential initiator, leader and motivator during its development. Part of this work was presented at the Internoise2006, 3-6 December 2006, Honolulu, Hawaii, USA.

8 Collaborators (in alphabetical order): Jean-Marie Berthelot (formerly Statistics Canada); France Désilets (Institut Raymond-Dewar); Pauline Fortier (Institut national de Santé publique du Québec); Martin Fortin (private audiologist practitioner); Susan Griest (Oregon Health and Sciences University); Mathieu Hotton (Institut de Réadaptation en Déficience physique de Québec); Rokho Kim (WHO European Centre for Environment and Health, Bonn Office); Chantal Laroche (University of Ottawa); Richard Larocque (Institut national de Santé publique du Québec); Marie Leblanc (Institut de Réadaptation en Déficience physique de Québec); Kristel LePetit (formerly Statistics Canada); Martin Hal Martin (Oregon Health and Sciences University); Colin D. Mathers (World Health Organization, Geneva); Michel Picard (University of Montreal); Annette Prüss-Üstün (World Health Organization, Geneva); Mireille Tardif (Institut Raymond-Dewar); and Ilse Maria Zalaman (University of Tübingen, Germany).

sification according to the patient's abilities and quality of life. In fact, there is no unique internationally recognized classification.

Tinnitus can cause in some patients one or several of the following consequences:

- sleep disturbance (difficulty in falling asleep or going back to sleep)
- cognitive effects (difficulty with attention and concentration)
- anxiety
- psychological distress
- depression (case reports of suicide)
- communication and listening problems (hearing problems)
- frustration
- irritability
- tension
- inability to work
- reduced efficiency
- restricted participation in social life.

Tinnitus annoyance and experienced handicap can be measured in clinical or research settings on an individual basis by several valid questionnaires. The severity grading classification (grade I to grade IV) as measured by the Tinnitus Severity Questionnaire developed by Goebel et al. is probably one of the most frequently used tinnitus questionnaires in Germany *(9)*. Other countries use different questionnaires that have good psychometric properties (i.e. good internal consistency and test–retest reliability), such as the Tinnitus Reaction Questionnaire *(10)*, which measures emotional tinnitus-related distress, the Tinnitus Handicap Questionnaire *(11)*, which measures the self-reported severity of tinnitus as a handicap, and the Tinnitus Handicap Inventory *(12)*, which quantifies the impact of tinnitus on everyday life. Psychoacoustical measurements of tinnitus can also be made. Typically, however, these measurements do not predict the psychological distress reported by patients *(13)*.

In population-based survey studies, simple questions about duration and the degree of annoyance caused by tinnitus are usually used, rather than the tools described above to assess the individual status. According to Davis *(6)*, at least two elements should be included into any epidemiological study: tinnitus that lasts for five minutes or more (additionally whether it is present for some or all the time); and an assessment of the impact of tinnitus (for example, severity or annoyance). The general agreement of the authors and contributors to this chapter is to focus, for burden of disease purposes, on the degree of severity of disabling tinnitus rather than on its duration.

The proposed operational case definition of tinnitus is a sound perception (for instance roaring, hissing, ringing, noise in the ears or the like) at the time of the survey or during the past year that cannot be attributed to an external sound source, and having disabling consequences in terms of constant disturbance of the emotional, cognitive, psychological or physical state of the patient. The term "constant" implies that the person has tinnitus that causes an impact on his or her functional life most of the time in at least one of these spheres.

Summary of evidence linking noise and tinnitus

A very small proportion of tinnitus cases signal the presence of an underlying treatable medical condition, such as a tumour or chronic partial opening of the Eustachian tube, but the majority of cases have no apparent or treatable cause. Tinnitus caused by excessive exposure to noise has long been described *(14–16)*. Fifty to 90% of patients with chronic noise trauma report tinnitus *(17)*.

Between 12% and 50% of persons with noise-induced hearing loss report having tinnitus *(18–21)*. Nevertheless, as stated before, tinnitus may be experienced by persons exposed to excessive noise who do not have measurable hearing loss *(3)*.

There is no single pathophysiological pathway to explain the occurrence of tinnitus. All structures of the auditory system have been suggested as possible sites of generation for tinnitus, from the periphery to the auditory cortex. Many explanatory models have been proposed, based on either anatomical, physiological, clinical or neuropsychological approaches. The underlying mechanisms responsible for transient and chronic tinnitus are most likely also different *(2)*. Despite those limitations in understanding the pathophysiology, however, there is no doubt that acute and chronic noise exposure can cause incapacitating tinnitus *(2,22)*. In noise-induced hearing loss and noise-induced tinnitus, it can be assumed that genesis is based on the same pathophysiological pathway *(23–27)*.

Hearing impairment is not expected to occur at $L_{Aeq,8h}$ levels of 75 dB(A) or below, even for prolonged occupational noise exposure. It is also expected that environmental noise exposure with a $L_{Aeq,24h}$ of 70 dB(A) or below will not cause hearing impairment in the large majority of people, even after a lifetime of exposure *(28)*. Although, to our knowledge, there are no empirical data to propose a no observed adverse effect level (NOAEL) for noise-induced tinnitus, it is reasonable and plausible to use the same protective NOAELs for tinnitus as those for noise-induced hearing loss. Therefore, for this burden of disease calculation, social/leisure noise is the most relevant source of exposure and concern for the EUR-A epidemiological subregion and North American countries, as these sources may typically exceed these thresholds. It is worth noting that traffic noise exceeds 85 dB(A) in some urban settings of developing countries *(29–31)*.

Exposure-response relationship

The exposure of interest in this context is leisure exposure, such as personal music players, gun shooting events, music concerts, sporting events and the use of firecrackers. To develop an exposure–response relationship, it would be necessary to find studies that linked these leisure noise exposures with the relative risk of occurrence of moderate to severe tinnitus. Although there are some studies based on this approach *(32–36)*, few could be identified and these did not cover all exposure settings. It was therefore not possible to develop an exposure–response relationship.

An alternative would be to estimate the relationship between noise and tinnitus derived from the risk curve relating noise exposure to hearing loss. This theoretical approach would be based on the existence of a valid quantitative relationship between noise-induced hearing loss levels and tinnitus risk. Should such a curve exist or be derived from existing data, the ISO 1999:1990 standard could be used to derive the risk of tinnitus per noise exposure level and duration. Although we know that the prevalence of tinnitus increases with the prevalence of noise-induced hearing loss, according to a recent literature review by Tyler *(37)* we are still not aware of any valid quantified relationship per hearing level between tinnitus prevalence and noise-induced hearing loss. Some authors do present data about this relationship, but we are not aware of any valid curves that could be used for burden of disease calculation.

Both these approaches also require population exposure data regarding the prevalence of exposure to leisure noise, which are not readily available at present.

Disability weight

There were no DWs readily available for tinnitus for burden of disease calculations. Three different approaches have been used to estimate DWs.

A first approach was for the authors to propose DWs by analogy with comparable diseases for which WHO already had DWs from the Global Burden of Disease Project. The best comparison proposed by the experts was with chronic pain, as this health problem shares several characteristics with tinnitus, such as: ongoing unwanted internal (centrally located) stimulus; causing or inducing co-morbidity (secondary symptoms) in terms of constant disturbance of the emotional, cognitive, psychological or physical state; not so well-understood pathophysiology; a lack of valid objective clinical findings or confirmatory laboratory tests; and possible response to cognitive therapy. Chronic pelvic pain has a DW of 0.122, whereas low back pain caused by chronic intervertebral disc protrusion has a DW of 0.121 (range 0.103–0.125). Other plausible comparisons are with cases of primary insomnia, which have a DW of 0.100 while a mild depressive episode has a DW of 0.140. As tinnitus may induce in some cases any of these two consequences, an interpolation in those ranges seemed reasonable. Thus, a DW of 0.120 was suggested *(38)*.

As this first approach was not considered to be very robust, a second approach was developed, based on the Canadian Population Health Impact of Disease Project, as an alternative to this first approach *(39)*. The preference scores (conceptually corresponding to one minus DW) were based on rating by health professionals and university experts using the Classification and Measurement System of Functional Health (CLAMES) *(40)* (see Appendix 1). This attempt did not give the expected results owing to unresolved methodological issues, and thus was not pursued.

Finally, an expert panel approach was undertaken. Based on all the available data, former proposals and an expert portrait of functional limitations caused by tinnitus (see Appendix 2), a third approach was proposed by the WHO expert on the Global Burden of Disease Project, Dr Colin D. Mathers, together with the WHO expert responsible for the Environmental Noise Burden of Disease Project, Dr Rokho Kim and the first author. This approach was based on the concept of "affecting ability to lead a normal life" (or affecting quality of life in terms of disabling consequences) within the definition of disabling tinnitus. Two different DWs for different levels of severity of disabling tinnitus were proposed: 0.01 for mildly (slightly) disabling tinnitus and 0.11 for an aggregate moderate and severely disabling tinnitus. These two severity weights are for limitations in leading a normal life. These provisional proposals, pending a more formal valuation exercise, are based on approximate correspondence to the following conditions in a Dutch DW study that used the same methodology as the Global Burden of Disease Project *(41)*. This study estimated the following DWs for activities of daily living (ADL) limitations in the elderly:

- no to mild ADL limitations in the elderly, 0.01 (range 0.006–0.012)
- moderate to severe ADL limitations in the elderly, 0.11 (range 0.056–0.174).

For comparison, this study gave low back pain an average weight of 0.06, mild to moderate agoraphobia and epilepsy both a weight of 0.11, and mild stable angina (NYHA class 1–2) a weight of 0.08. Some comparable weights used in the GBD 2001 update of the Global Burden of Disease Study include:

- primary insomnia (causing problems with usual activities), 0.10
- dysthymia, 0.14
- moderate iron deficiency (80–109 g/l haemoglobin in women), 0.011.

It is worth mentioning that the DW of 0.11 for moderate to severely disabling tinnitus is very close to the proposed DW of 0.120 that emerged from the first approach. Therefore, DWs of 0.01 for slightly disabling tinnitus and of 0.11 for moderate to severely disabling tinnitus are used for the burden of disease calculations in this chapter.

EBD calculations

Outcome-based approach for leisure-noise-induced tinnitus in the EUR-A epidemiological subregion

The approach chosen for this chapter uses survey-based studies to estimate the prevalence of tinnitus on a population basis. With this approach, it is necessary to estimate the attributable portion of tinnitus caused by environmental noise exposure.

Prevalence of the outcome

A comprehensive review of the literature was made using published documents as identified by PubMed's internet resource through Laval University's Ariane search tool (http://ariane.ulaval.ca/web2/tramp2.exe/log_in?setting_key=french), references cited in selected articles, the authors and contributors of unpublished documents, and experts' opinions. When more than one published article was based on the same study population and design, the later or updated version was used.

The three research strategies retrieved more than 400 studies in English, French, Spanish or German. From that first extraction, 99 were selected as being potentially of interest. A global quality assessment of the studies was done independently by two reviewers, who classified each study as pass or fail based on criteria including external validity, internal validity and data analysis. Disagreements on the inclusion/exclusion of articles were resolved by consensus among the reviewers. Once studies were selected, a data extraction form was used. This process led to the identification of 23 epidemiological studies of interest that met minimal specified quality criteria and these were presented in a background paper *(38)*.

To select the studies that are to be used for burden of disease calculations, the authors identified those that estimated point prevalence. Also, sampling had to be random and population-based. The authors analysed, when available, the wording of the questions. There is no internationally recognized standard definition of disabling tinnitus. None of the questions used in these studies answered specifically and in a standardized manner all the consequences of chronically disabling tinnitus. The selected studies estimated the prevalence of tinnitus through various concepts such as annoyance, difficulty falling asleep, and tinnitus moderately or very bothersome. Table 5.1 gives a summary of the six selected studies, with specification of the potential disability concept that could be used in each one. All six are cross-sectional descriptive prevalence studies estimating a point or yearly prevalence, based on random samples of the study population.

Table 5.1. Summary of studies selected for burden of disease calculations for tinnitus

Reference (age group in years, country) [sample size]	Question	Selected potential disability concept
Axelsson & Ringdahl *(42)* (20–80, Sweden) [3600]	Do you suffer from tinnitus?	Question 6. Severity of tinnitus (mark the most appropriate alternative) Tinnitus does not bother me particularly Tinnitus bothers me only in quiet surroundings Tinnitus disturbs my sleep [...] Tinnitus plagues me all day
Davis *(43)* (17+, England) [48 313]	Nowadays do you get noises in your head or ears?	Tinnitus affecting quality of life
Hannaford et al. *(44)* 2005 (14+, Scotland) [15 788]	(missing exact question) ["Most questions related to current or recent (within the previous twelve months) symptoms ... "]	Tinnitus problems "affected their ability to lead a normal life"
Nondahl et al. *(21)* 2002 (48–92, USA) [3737]	In the past year, have you had buzzing, ringing, or noise in your ears?	"Significant tinnitus" if at least moderate tinnitus or tinnitus causing difficulty in falling asleep
Paré & Levasseur *(45)* (15+, Canada) [20 773]	Do you hear ringing, buzzing or whistling noises in your ears or head that last 5 minutes or more at a time?	Do these noises [tinnitus] bother you? (moderately or a lot)
Sindhusake et al. *(18)* (55–99, Australia) [2015]	Have you experienced any prolonged ringing, buzzing or other sounds in your ears or head within the past year, that is, lasting for 5 minutes or longer?	Tinnitus "gets you down"

As the most common complaint from tinnitus sufferers is sleep disturbance, a first proposal by the experts was to use these data for burden of disease purposes. Although this was appealing, these results give only a partial picture of all the possible consequences of tinnitus. Of all the concepts used in the selected studies, those used by Davis *(43)* and by Hannaford *(44)*, as presented in Table 5.1, match more closely the global concept of disabling tinnitus and the similar concepts used for burden of disease calculations for other health problems. Therefore, the results of these two studies were used for burden of disease calculations of tinnitus induced by environmental noise. Despite the fact that the concepts used in these two studies do not correspond exactly to the wording of the operational case definition, the authors consider that these concepts match in an acceptable and reasonable way our definition of disabling tinnitus for calculating DALYs. Studies using similar concepts for disabling tinnitus could eventually be used for burden of disease calculations.

Based on the two selected studies, the authors calculated a weighted prevalence (with weights based on sample size) of tinnitus according to severity level (Table 5.2).

Table 5.2. Weighted population prevalence calculation for disabling tinnitus

Reference	Sample size (age group)	No. of cases of disabling tinnitus		
		Slight	Moderate	Severe
Davis *(43)*	19 023 (17+)	634 (3.3%)	228 (1.2%)	83 (0.4%)
Hannaford et al. *(44)*	15 788 (14+)	564 (3.6%)	189 (1.2%)	59 (0.4%)
Weighted mean prevalence	—	3.4	1.2	0.4

The general trend for the relationship between tinnitus prevalence and age generally shows that tinnitus prevalence increases with age and decreases after 60–70 years of age *(6)*. Hannaford et al. *(44)* do not present the results by age group for disabling tinnitus. Davis *(6)* reports an increasing prevalence with age for disabling tinnitus (see Table 5.3). For burden of disease calculations, the crude prevalence rate was used, as both studies cover almost the same age range (14 years and over or 17 years and over) and were done in two countries that have similar age distributions. For countries with different age distributions than European countries, the prevalence data by age group presented in chapter 9, Tables: section 1 page 901 under "Tinnitus affecting quality of life" of reference 43 can be used.

There are no clinically or statistically significant gender differences for noise-induced tinnitus *(6,38)*. Therefore, the authors suggest not taking gender into account for burden of disease calculations of tinnitus induced by environmental noise.

Prevalent cases in EUR-A countries were calculated based on population data extracted from the European health for all database *(46)* (Table 5.3). There is some evidence that noise-induced tinnitus is present in children *(47)*. To our knowledge, there are no population data on the prevalence of tinnitus in children. As the available prevalence data are based on two population studies of young people aged 14 years and over and 17 years and over, respectively, prevalent cases in EUR-A countries were calculated for age 15 years and over. The year 2001 was used for this example of calculation for comparison with *The world health report 2002 (48)*.

Table 5.3. Population and prevalent cases of disabling tinnitus per severity level for the WHO EUR-A epidemiological subregion, 15 years old and over, 2001

Total population	Population aged 15 years and over	Weighted prevalence per severity level	Prevalent cases of disabling tinnitus by severity level
413 967 744	344 131 386	Slight: 3.4%	11 845 523
		Moderate: 1.2%	4 122 166
		Severe: 0.4%	1 407 670
		Total	17 375 359

Attributable fraction of the outcome

As mentioned above, the prevalence approach involves proposing an attributable fraction of tinnitus specifically caused by environmental noise exposure in order to be able to calculate environmental noise burden of disease. Most studies reviewed, including the two selected ones, report the prevalence of tinnitus in the study population with no direct reference to cause. The few that do address cause do not specifically address environmental noise as a causal factor. There is no particular clinical presentation of tinnitus induced by environmental noise compared to tinnitus from other causes.

For burden of disease purposes, a case of environmental-noise-induced tinnitus is one that corresponds to the exclusive case definition. Cases due to mixed causes such as occupational and environmental noise exposures should be excluded from the attributable fraction. This choice will tend to give a conservative estimate of burden of disease due to tinnitus induced by environmental noise.

Only two data sources were readily available to estimate the population-attributable fraction for environmental noise. One is based on a large study in which 1535 patients attending the Tinnitus Clinic at the Oregon Health & Science University answered a standardized questionnaire. Among the 1406 patients with a valid noise exposure history, 16.2% (228/1406) reported having been exposed to recreational noise without any occupational or military exposures. Of these patients, 199 (14.2%) reported having usually or always at least one of 15 disability items. To the question "Were illness, accident or other special circumstances associated with the onset of your present tinnitus?", 26 (1.8%) reported that the onset of tinnitus was associated with exclusive recreational noise exposure. This last figure should be considered as an absolute minimum for this population, as people often do not relate the onset of their tinnitus with noise exposure unless it began suddenly following a brief, intense exposure (S.E. Griest & W.H. Martin, unpublished data, 2008).

The other available estimation is from Girard & Simard, who produced preliminary results based on a large medical surveillance database of over 88 320 workers' audiometric examinations carried out between 1983 and 1996 (S.A. Girard & M. Simard, unpublished data, 2005). After adjustment for occupational noise exposure level and duration, hearing level and age, the estimated attributable fraction of tinnitus caused exclusively by hobby or leisure noise exposure was 4.6% for this cohort *(38)*.
A third source of information was used. The authors asked 14 audiology experts (clinicians, rehabilitation centre professionals and university professors), one specialized psychologist and two ear, nose and throat medical specialists for their opinion on their estimation of the attributable portion of tinnitus caused exclusively by environmental

noise exposure. The experts first gave an individual estimate of the attributable fraction with figures ranging from 1% to 15%. After discussing this issue during a meeting with a subgroup of the same experts, based on the three available data sources, the consensus was for an estimated attributable fraction of 3% as a conservative but plausible and reasonable figure.

Calculation of DALYs

According to current knowledge and the data presented, the authors consider that there is no premature mortality caused by environmental-noise-induced tinnitus and therefore no YLL. Even though there are some reports of tinnitus sufferers committing suicide *(49)*, these are likely to be already accounted for in calculations of burden of disease attributed to suicide.

Table 5.4 presents the calculations of DALYs for disabling tinnitus, without reference to cause, for the WHO EUR-A epidemiological subregion in 2001.

Table 5.4. DALY calculation for disabling tinnitus per severity level for WHO EUR-A epidemiological subregion, 15 years of age and over, 2001

Severity	Prevalent cases	Disability weight	DALYs
Slight	11 845 523	0.01	118 455
Moderate	4 122 166	0.11	453 438
Severe	1 407 670	0.11	154 844
Total	17 375 359	–	726 737

As a comparison, the burden of non-cause-specific disabling tinnitus in EUR-A countries is higher than that of lower respiratory infections and several other well-recognized health problems (Table 5.5).

Table 5.5. Comparison of burden of disease for disabling tinnitus with some other common health problems, EUR-A epidemiological subregion, 2001

Health problem	DALYs
Unipolar depressive disorders	4 091 000
Hearing loss, adult onset	1 857 000
Diabetes mellitus	1 083 000
Disabling tinnitus	726 000
Lower respiratory infections	614 000
Oral diseases	353 000
Prostate cancer	335 000
Hypertensive heart disease	317 000
HIV/AIDS	208 000
Sexually transmitted diseases, excluding HIV	79 000

Source: World Health Organization *(48)* (except for disabling tinnitus).

DALYs for environmental-noise-induced disabling tinnitus for the WHO EUR-A epidemiological region in 2001 are presented in Table 5.6 by introducing the 3% population-attributable fraction into the calculations.

Table 5.6. Calculation of DALYs for environmental noise induced tinnitus by severity level for the WHO EUR-A epidemiological subregion, 15 years of age and over, 2001

Severity	Prevalent cases	Disability weight	Population-attributable fraction	DALYs
Slight	11 845 523	0.01	0.03	3 554
Moderate	4 122 166	0.11	0.03	13 603
Severe	1 407 670	0.11	0.03	4 645
Total	17 375 359	—	—	21 802

As a comparison, the burden of disease for environmental-noise-induced disabling tinnitus is higher than that for cataracts or hepatitis B in EUR-A countries (Table 5.7).

Table 5.7. Comparisons of burden of disease for environmental-noise-induced disabling tinnitus with some other common health problems, WHO EUR-A epidemiological subregion, 2001

Health problem (from all causes unless mentioned)	DALYs
Mild mental retardation caused by lead[a]	55 000
Hepatitis C[b]	30 000
Upper respiratory infections[b]	26 000
Environmental-noise-induced disabling tinnitus	22 000
Cataracts[b]	19 000
Hepatitis B[b]	18 000
Appendicitis[b]	16 000
Periodontal disease[b]	16 000
Gonorrhoea[b]	15 000

[a] *Source*: Fewtrell L et al. *(50)*.
[b] *Source*: World Health Organization *(48)*.

These calculations are likely to be valid for the WHO EUR-A epidemiological subregion. They are based on valid population prevalence data corresponding reasonably to the case definition and with DWs matching this case definition, using a rather conservative but plausible impact fraction. Although several aspects of the calculation method are based on expert opinion, all the best available data were integrated into a systematic logical reproducible analysis.

Uncertainties, limitations and challenges

Accuracy of estimates of tinnitus prevalence

The approach chosen for this chapter uses survey-based studies to estimate the prevalence of tinnitus on a population basis. Depending on the questions used for each individual survey, the results may represent anything from lifetime to point prevalence of tinnitus, with or without considerations of duration or severity. In a recent review of the literature *(38)*, prevalence of tinnitus varied from 3% to 36%.

Burden of disease calculations being based on an annual occurrence of the event of interest multiplied by duration, the prevalence data used must reflect a yearly prevalence. Therefore, only point prevalence data, or at the most the previous year's data on disabling tinnitus should be considered.

This approach has some limits for calculating global burden of disease: the prevalence of tinnitus may be different from one country to another; and the survey questions vary from one study to another as there is no standardization of questionnaires. Also, cross-sectional studies have some limitations as they cannot assess the evolution of the problem in terms of fluctuations in duration and severity.

Clinical studies reveal that some individual cases of tinnitus do fluctuate over time from more to less disabling and vice versa *(6)*. Nevertheless, it is assumed that, on average, the overall prevalence will remain stable all year round on a population level.

Lack of exposure data

To our knowledge, there are no valid population data available at present on the prevalence of exposure to leisure-time noise sufficient to induce tinnitus.

Calculating burden of disease in countries other than those in Europe

The authors were unable to identify population data on disabling tinnitus outside the Organisation for Economic Co-operation and Development (OECD) countries. As tinnitus is by essence a subjective experience, its natural history may differ in different cultural settings. The authors consider that it may be risky to infer similar prevalences for economically developing countries as those found in the selected studies. For instance, as stated above, traffic noise in some urban settings is above the levels that can produce tinnitus, thus likely adding to the number of noise sources that induce disabling tinnitus and therefore to the attributable fraction of environmental-noise-induced tinnitus. Should national burden of disease calculations for environmental-noise-induced tinnitus be estimated, calculations should adjust for the age distribution of the target population.

Some experts are convinced that the burden of tinnitus is influenced by the cultural situation. For instance, given that moderate tinnitus can impair cognitive functions such as auditory working memory and visual attention span *(51,52)*, the burden may be higher in cultures with frequent highly demanding professional work, where tinnitus may contribute to unacceptable mistakes.

Conclusions

To our knowledge, the global burden of disease for disabling tinnitus or environmental-noise-induced tinnitus has never been estimated before. The epidemiology of functional limitations caused by tinnitus is rather scarce and even more so for environmental-noise-induced tinnitus.

Although the proposed approach is in some aspects based on expert opinion, hopefully it will be useful as a starting place from which to better ascertain the burden of suffering caused by tinnitus. One of the fundamental goals in constructing summary measures of health is to identify the relative magnitude of different health problems, including diseases, injuries and risk factors *(53)*. The estimate of environmental-noise-induced tinnitus presented in this chapter is based on the best available science and may err on the conservative side, according to the authors. Therefore, it is our hope that this work will help to better understand and value the importance of diseases such as tinnitus, which are often not very well known or understood outside specific expert circles, and therefore not a very high priority in the political agenda.

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Appendix 1. Classification and Measurement System of Functional Health (CLAMES)

Core attributes

Pain or discomfort	1. Generally free of pain and discomfort 2. Mild pain or discomfort 3. Moderate pain or discomfort 4. Severe pain or discomfort
Physical functioning	1. Generally no limitations in physical functioning 2. Mild limitations in physical functioning 3. Moderate limitations in physical functioning 4. Severe limitations in physical functioning
Emotional state	1. Happy and interested in life 2. Somewhat happy 3. Somewhat unhappy 4. Very unhappy 5. So unhappy that life is not worth while
Fatigue	1. Generally no feelings of tiredness, no lack of energy 2. Sometimes feel tired, and have little energy 3. Most of the time feel tired, and have little energy 4. Always feel tired, and have no energy
Memory and thinking	1. Able to remember most things, think clearly and solve day-to-day problems 2. Able to remember most things but have some difficulty when trying to think and solve day-to-day problems 3. Somewhat forgetful, but able to think clearly and solve day-to-day problems 4. Somewhat forgetful, and have some difficulty when trying to think or solve day-to-day problems 5. Very forgetful, and have great difficulty when trying to think or solve day-to-day problems
Social relationships	1. No limitations in capacity to sustain social relationships 2. Mild limitations in capacity to sustain social relationships 3. Moderate limitations in capacity to sustain social relationships 4. Severe limitations in capacity to sustain social relationships 5. No capacity or unable to relate to other people socially

Supplementary attributes

Anxiety	1. Generally not anxious 2. Mild levels of anxiety experienced occasionally 3. Moderate levels of anxiety experienced regularly 4. Severe levels of anxiety experienced most of the time
Speech	1. Able to be understood completely when speaking with strangers or friends 2. Able to be understood partially when speaking with strangers but able to be understood completely when speaking with people who know you well 3. Able to be understood partially when speaking with strangers and people who know you well 4. Unable to be understood when speaking to other people
Hearing	1. Able to hear what is said in a group conversation, without a hearing aid, with at least three other people 2. Able to hear what is said in a conversation with one other person in a quiet room, with or without a hearing aid, but require a hearing aid to hear what is said in a group conversation with at least three other people 3. Able to hear what is said in a conversation with one other person in a quiet room, with or without a hearing aid, but unable to hear what is said in a group conversation with at least three other people 4. Unable to hear what others say, even with a hearing aid
Vision	1. Able to see well enough, with or without glasses or contact lenses, to read ordinary newsprint and recognize a friend on the other side of the street 2. Unable to see well enough, even with glasses or contact lenses, to recognize a friend on the other side of the street but can see well enough to read ordinary newsprint 3. Unable to see well enough, even with glasses or contact lenses, to read ordinary newsprint but can see well enough to recognize a friend on the other side of the street 4. Unable to see well enough, even with glasses or contact lenses, to read ordinary newsprint or to recognize a friend on the other side of the street
Use of hands and fingers	1. No limitations in the use of hands and fingers 2. Limitations in the use of hands and fingers, but do not require special tools or the help of another person 3. Limitations in the use of hands and fingers, independent with special tools and do not require the help of another person 4. Limitations in the use of hands and fingers, and require the help of another person for some tasks 5. Limitations in the use of hands and fingers, and require the help of another person for most tasks

Source: Public Health Agency of Canada (http://www.phac-aspc.gc.ca/phi-isp/state_preference-eng.php#clames).

Appendix 2. CLAMES description of a typical (median or average) case of disabling tinnitus causing some consequences

CLAMES attribute	Experts' description of consequence of tinnitus	Corresponding CLAMES descriptor*	CLAMES score
Pain or discomfort	Moderate physical discomfort as the person hears the sound in a lot of day-to-day circumstances (discomfort refers to an unpleasant sensation that is not pain, such as nausea or itching)	Moderate pain or discomfort	3
Physical functioning	Generally no limitations in physical functioning	Generally no limitations in physical functioning	1
Emotional state	More unhappy or sad than happy during waking hours (more than 50% of the time unhappy), [...]	Somewhat unhappy (you are not completely unhappy, but you are more unhappy than happy)	3
Fatigue	[...] with little energy and feeling tired most of the time	Most of the time feel tired, and have little energy (most of your waking hours are spent feeling tired or fatigued)	3
Memory and thinking	No problems with memory or thinking clearly, but will have some difficulty in solving day-to-day problems (tinnitus influence on cognition, on thinking capacity and on attention)	Able to remember most things but have some difficulty when trying to think and solve day-to-day problems	2
Social relation-ships	Induces mild limitations in the capacity to sustain social relationships (will limit the number of people and of groups of people they relate to)	Mild limitations in the capacity to sustain social relationships (you have an inhibited capacity for social relationships: you do not always have the ability to maintain the full range of usual social relationships)	2
Anxiety	Anxiety is a hallmark of tinnitus causing consequences (sequelae): there is a high level of anxiety experienced most of the time; there is a feeling of loss of control and helplessness	Severe levels of anxiety experienced most of the time (you experience excessive uneasiness, worry or fear most of the time)	4
Speech	No effect on speech	Able to be understood completely when speaking with strangers or friends	1

CLAMES attribute	Experts' description of consequence of tinnitus	Corresponding CLAMES descriptor*	CLAMES score
Hearing	The independent effect of tinnitus on communication is rather difficult to pinpoint, as a majority of tinnitus sufferers do have some hearing impairment (these are two concomitant health problems that may both affect communication capacities); hearing impairment affects particularly communication in a group conversation; Zenner states that the communication problems do not have the same origin for hearing loss and tinnitus; for tinnitus patients with hyperacusis without hearing loss, often hyperacusis is the source of difficulties communicating in groups of 3 or more people; better descriptor for tinnitus is that it causes more of a discomfort or intolerance in situations of group conversations, rather than an impossibility to hear a conversation; nevertheless, the experts consider that, on average, tinnitus does cause some communication problems in groups	Able to hear what is said in a conversation with 1 other person in a quiet room, with or without a hearing aid, but require a hearing aid to hear what is said in a group conversation with at least 3 other people Able to hear what is said in a conversation with 1 other person in a quiet room, with or without a hearing aid, but unable to hear what is said in a group conversation with at least 3 other people	3 (2)
Vision	No effect on vision	Able to see well enough, with or without glasses or contact lenses, to read ordinary newsprint and recognize a friend on the other side of the street	1
Use of hands and fingers		No limitations in the use of hands and fingers	1

6. ENVIRONMENTAL NOISE AND ANNOYANCE

Henk Miedema
Sabine Janssen
Rokho Kim

Noise annoyance is widely accepted as an end-point of environmental noise that can be taken as a basis for evaluating the impact of noise on the exposed population. As a consequence, EU Directive 2002/49/EC *(1)* recommends evaluating environmental noise exposures on the basis of estimated noise annoyance.

As discussed in Chapter 1, WHO defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" *(2)*. This implies that noise-induced annoyance may be considered an adverse effect on health. People annoyed by noise may experience a variety of negative responses, such as anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation or exhaustion *(3–5)*. Furthermore, stress-related psychosocial symptoms such as tiredness, stomach discomfort and stress have been found to be associated with noise exposure as well as noise annoyance *(6,7)*. Some public health experts feel that severe forms of noise-related annoyance should be considered a legitimate environmental issue affecting the well-being and quality of life of the population exposed to environmental noise. The most important issue in the present context is to what extent health (according to the broad definition given above) is reduced by noise and whether a DW that expresses this reduction, when combined with the prevalence of annoyance, leads to a significant burden of "disease". The other possibility would be that noise annoyance does not significantly contribute to disability and, hence, should not be taken into account when considering the noise-induced burden of disease.

In this chapter, a method for estimating the burden of annoyance due to noise is proposed and illustrated, and related issues are discussed. The method was developed by the Netherlands National Institute for Public Health (RIVM) *(8)* and initially applied to the Netherlands. First, a closer look is taken at noise annoyance in the context of burden of disease calculations.

Definition of outcome

Noise annoyance is assessed at the level of populations by means of a questionnaire. Efforts have been made by the International Commission on Biological Effects of Noise and the International Organization for Standardization *(9)* towards the use of standardized questions asking for the degree of annoyance, and introducing an 11-point numerical scale and a 5-point semantic scale. Recoding scales into a 0–100 annoyance response scale, cut-off values of 50 and 72 have been used to determine the percentage of people annoyed and highly annoyed, respectively. For the 5-point scale, however, cut-off values of 40 and 60 are also in use, matching the three highest categories for annoyance and the two highest categories for high annoyance. The percentage highly annoyed, i.e. the percentage of persons with a response exceeding 72, is the most widely used indicator of the prevalence of annoyance in a population, although percentages using other cut-offs or the mean annoyance may also be used *(10)*. In the case study included in this chapter, high annoyance is used as the annoyance indicator. Using a lower cut-off value would give higher prevalence but would be associated with a lower DW, resulting in either a higher or a lower estimate of the burden caused by noise annoyance. An important reason for using highly annoyed as the cut-off is the expectancy that only for rather severe annoyance may it be possible to gain consensus on a DW that can be meaningfully distinguished from zero.

Provided it contributes significantly, annoyance due to environmental noise can be included in estimates of the burden related to environmental noise when (*a*) the noise exposure of the population is known, (*b*) exposure–response relationships are available for estimating the annoyance on the basis of the exposures, and (*c*) a DW is attached to noise annoyance. In principle, it is also possible to replace steps (*a*) and (*b*) by direct estimates of annoyance prevalence through an annoyance survey in the population concerned (outcome-based approach).

Traffic noise exposure

Within the framework of Directive 2002/49/EC *(1)*, exposure data have been provided by agglomerations with more than 250 000 inhabitants, as reported by the Noise Observation and Information Service for Europe (NOISE) of the European Environment Agency (EEA) *(11)*. While not all Member States have reported yet, and some differences between Member States may be attributed to methodological differences rather than differences in exposure, these data provide an indication of the exposure distribution within large urban areas in the EU. The distribution of exposure to road traffic noise in Member States was used based on 110 million people, the total number of inhabitants in the agglomerations for which a report had been provided up to June 2010 *(11)*. It is assumed here that the observed exposure distribution may apply to the total urban population within the EU living in cities or agglomerations with more than 50 000 inhabitants, which is estimated to be around 285 million people (57% of the total EU population).

Exposure-response relationship

The EU Position Paper on dose–response relationships between transportation noise and annoyance *(12)* presented synthesis curves for noise annoyance from aircraft, road traffic and railway noise, with their 95% confidence intervals taking into account the variation between individuals and studies. These curves were based on all studies examined by Schultz *(13)* and Fidell et al. *(14)* for which L_{den} (and L_{dn}), and the percentage of "highly annoyed" persons (%HA) meeting certain minimal requirements could be derived, augmented by a number of additional studies *(10)*. The raw data from a total of 54 studies from Europe, North America and Australia investigating noise annoyance from road traffic, aircraft and railways were analysed. The percentage of "highly annoyed" persons (%HA) as a function of noise exposure indicated by L_{den} was found to be the following.

Aircraft:
$\%HA = -9.199 \cdot 10^{-5} (L_{den} - 42)^3 + 3.932 \cdot 10^{-2} (L_{den} - 42)^2 + 0.2939 (L_{den} - 42)$

Road traffic:
$\%HA = 9.868 \cdot 10^{-4} (L_{den} - 42)^3 - 1.436 \cdot 10^{-2} (L_{den} - 42)^2 + 0.5118 (L_{den} - 42)$

Railways:
$\%HA = 7.239 \cdot 10^{-4} (L_{den} - 42)^3 - 7.851 \cdot 10^{-3} (L_{den} - 42)^2 + 0.1695 (L_{den} - 42)$

Data below 45dB and above 75dB (L_{den}) were excluded because the risk of unreliable noise data is high at very low levels, whereas the risk of selection of "survivors" is high at very high levels. The confidence intervals found were narrow, indicating that, even though there is considerable variation between individuals and between studies, the uncertainty regarding the relationships between noise exposure and annoyance is rather limited.

In the same way, and based on the same data, Miedema & Oudshoorn *(10)* established the following relationships for L_{dn}.

Aircraft:
$\%HA = -1.395 \cdot 10^{-4} (L_{dn} - 42)^3 + 4.081 \cdot 10^{-2} (L_{dn} - 42)^2 + 0.342 (L_{dn} - 42)$

Road traffic:
$\%HA = 9.994 \cdot 10^{-4} (L_{dn} - 42)^3 - 1.523 \cdot 10^{-2} (L_{dn} - 42)^2 + 0.538 (L_{dn} - 42)$

Railways:
$\%HA = 7.158 \cdot 10^{-4} (L_{dn} - 42)^3 - 7.774 \cdot 10^{-3} (L_{dn} - 42)^2 + 0.163 (L_{dn} - 42)$

Disability weight

Given the limited number of studies on a DW for annoyance, and the sensitivity of the environmental burden attributed to noise annoyance for small changes in DW, a tentative DW of 0.02 is proposed with a relatively large uncertainty interval (0.01–0.12). The minimum value (0.01) is based on the value used by de Hollander et al. *(15)* and by Stassen et al. *(16)* in environmental burden of disease calculations. The maximum value (0.12) is based on the mean DW found for severe annoyance by Van Kempen (cited in Knol & Staatsen) *(17)*, who did a pilot study among 13 medical experts, working according to a protocol by Stouthard et al. *(18)*. De Hollander *(19)* expanded this study to 35 environmental physicians, epidemiologists and public health professionals and also assessed a mean DW of 0.12 (median: 0.07; standard deviation: 0.16; range 0–0.35) using the same protocol. The relatively high DW for annoyance in these studies may be explained by the presentation of the definition of annoyance with the description that annoyance could lead to various symptoms such as being not (95%) or mildly (5%) anxious or depressed, and having no (95%) to some (5%) cognitive impairment. In addition, Müller-Wenk *(20)* found a mean DW of 0.033 (median: 0.03; range: 0.01–0.12) for communication disturbance based on a survey of 42 Swiss physicians, which may apply to annoyance related to daytime noise exposure. Based on these data and taking a "conservative approach", here only severe cases of annoyance (highly annoyed) are given DW 0.02 for estimation of burden in terms of DALYs.

EBD calculations

Here we provide a method for estimating the environmental burden of disease for noise, estimating the prevalence of noise annoyance by combining exposure data with the exposure–response relationships for noise annoyance. One year is proposed as the duration for exposure causing severe annoyance, as annoyance is an effect that disappears when the noise stops. Age was not considered, assuming that children are annoyed in the same way as adults. While this assumption seems justified, since children showed similar patterns of annoyance to those of their parents *(21)*, it may lead to a slight overestimation since annoyance does not appear to be a relevant concept for infants.

We calculated the DALYs for noise annoyance using the exposure distribution in L_{den} presented by EEA *(11)* for large agglomerations (> 250 000 inhabitants), the exposure–response relationships for annoyance (with expected percentage of highly annoyed people at the midpoint of the category, as a function of L_{den} in the range 42–80 dB(A)) and a range of DWs. This calculation suggests that there are about 587 000 DALYs lost due to noise-induced annoyance within the EU population living in urban areas. Taking 0.01 and 0.12 as the extremes of the range for DWs, the credible range for the DALYs is 0.29–3.52 million (Tables 6.1–6.4). It should be noted that the burden in rural areas or small town with less than 50 000 inhabitants is not included here, and that we took a very conservative assumption about the exposure distribution below 50 dB(A).

Table 6.1. DALYs for highly annoyed people due to road traffic noise in the EU

Exposure category L_{den} (dB(A))	Percentage of population exposed [a]	Percentage of people highly annoyed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.01	DW = 0.02	DW = 0.12
< 55	50	2.77	13 835	39 430	78 859	473 155
55–59	17	8.16	13 868	39 524	79 047	474 285
60–64	19	12.96	24 621	70 170	140 341	842 044
65–69	9	20.08	18 068	51 494	102 989	617 933
70–74	4	30.25	12 100	34 485	68 969	413 815
> 75	1	30.25[d]	3 025	8 621	17 242	103 454
Total	100		85 517	243 724	487 448	2 924 686

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.

[b] The percentage and number of cases were calculated using the mid-level value of each exposure category. For the category of < 55 dB(A), the mid-level value was conservatively set to 48 dB(A).

[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.

[d] As the exposure–response function does not apply to the range over 75 dB(A), the percentage of people highly annoyed in this exposure category was assumed to be the same as in the 70–74 dB(A) category.

Table 6.2. DALYs for highly annoyed people due to rail traffic noise in the EU

Exposure category L_{den} (dB(A))	Percentage of population exposed[a]	Percentage of people highly annoyed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.01	DW = 0.02	DW = 0.12
< 55	95	0.89	8 462	24 116	48 233	289 397
55–59	3	3.44	1 031	2 938	5 877	35 261
60–64	1	6.41	641	1 827	3 655	21 929
65–69	1	11.22	1 122	3 198	6 396	38 374
70–74	0	18.41	0	0	0	0
> 75	0	18.41[d]	0	0	0	0
Total	100		11 256	32 080	64 160	384 960

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.

[b] The percentage and number of cases were calculated using the mid-level value of each exposure category. For the category of < 55 dB(A), the mid-level value was conservatively set to 48 dB(A).

[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.

[d] As the exposure–response function does not apply to the range over 75 dB(A), the percentage of people highly annoyed in this exposure category was assumed to be the same as in the 70–74 dB(A) category.

Table 6.3. DALYs for highly annoyed people due to air traffic noise in the EU

Exposure category L_{den} (dB(A))	Percentage of population exposed[a]	Percentage of people highly annoyed[b]	Number of cases per million[b]	DALYs lost in the urban population[c]		
				DW = 0.01	DW = 0.02	DW = 0.12
< 55	96	3.16	30 327	33 360	66 719	400 315
55–59	3	13.66	4 098	11 679	23 358	140 147
60–64	1	21.76	2 176	6 201	12 401	74 408
65–69	0	31.54	0	0	0	0
70–74	0	42.93	0	0	0	0
> 75	0	42.93[d]	0	0	0	0
Total	100		36 601	17 880	35 759	214 555

[a] The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.

[b] The percentage and number of cases were calculated using the mid-level value of each exposure category. For the category of < 55 dB(A), the mid-level value was conservatively set to 48 dB(A).

[c] DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.

[d] As the exposure–response function does not apply to the range over 75 dB(A), the percentage of people highly annoyed in this exposure category was assumed to be the same as in the 70–74 dB(A) category.

Table 6.4. DALYs for highly annoyed people due to all traffic noise in the EU[a]

Source of traffic noise	DALYs		
	DW = 0.01	DW = 0.02	DW = 0.12
Road	243 724	487 448	2 924 686
Rail	32 080	64 160	384 960
Air	17 880	35 759	214 555
Total	293 684	587 367	3 524 201

[a] For the 285 million population living in agglomerations with > 50 000 inhabitants.

Uncertainties, limitations and challenges

Alternative approaches

The burden in terms of DALYs may also be directly estimated on the basis of noise annoyance survey data in the population concerned, if available. However, we expect that the approach starting with the noise exposure levels will be most feasible in the future with the increase of the noise exposure mapping effort. Moreover, it is less sensitive to the idiosyncrasies of the different surveys conducted in different populations and the differences in the processing of the data obtained with the surveys, and it is less sensitive to temporary factors affecting the response of a population surveyed. Therefore, provided that the noise exposure assessment is sufficiently harmonized, the approach that estimates the prevalence of noise annoyance by combining exposure data with the exposure–response relationships for noise annoyance appears to be most promising.

Choice of the exposure-response relationship for annoyance

Various authors have synthesized existing data from community annoyance surveys to develop an exposure–response relationship for use in environmental impact analyses and related community planning efforts, such as Schultz *(13)*, Fidell et al. *(14)* and Miedema & Oudshoorn *(10)*. Schultz recognized the preliminary nature of his original synthesis curve, and did not expect it to remain the final word for long *(19)*. The most comprehensive of these meta-analyses is clearly that published in 2001 by Miedema & Oudshoorn *(10)*. There are, however, two types of qualification that have to be made, which are not elaborated on here:

- the relationships can be refined by taking into account non-acoustical factors and, probably more relevant, acoustical factors that can be affected by policy other than the exposure at the most exposed side, such as sound insulation of the dwelling or the presence or absence of a quiet side *(7)*; and

- there are strong indications that the exposure–response relationships for aircraft noise have changed, so that the curves presented here probably underestimate the annoyance at a given aircraft noise exposure level *(20)*.

Uncertainty with respect to the exposure-response relationship

One cause of doubt regarding the predictability of noise annoyance is that the studies show a large variation in individual annoyance reactions to the same noise exposure level. The other cause of doubt is that attempts to integrate the results from different studies show that there is a large variation in the relationships found in different studies. The large individual variation and the large study variation suggest that it is difficult to predict annoyance with sufficient accuracy. Indeed, the annoyance response of a particular individual or group of individuals can be predicted on the basis of the exposure only with a large amount of uncertainty. This uncertainty can be described by the prediction interval for individuals or groups around the exposure–response curves.

Nevertheless, in most cases, the uncertainty regarding individual or group reactions is not what matters for noise policy. Most policy, including that based on estimates of the burden of disease due to environmental noise, is made with a view to the overall reaction to exposures in a (reference) population. This means that it is not the uncertainty with respect to the prediction of an individual or group reaction that is important, but the uncertainty regarding the exact relationship between exposure and response in the (reference) population. The accuracy of the estimation of this relationship is described by the confidence interval around the curve. If properly established, the confidence interval takes into account the variation between individuals as well as the variation between studies. As found by Miedema & Oudshoorn *(10)*, this results in relatively narrow confidence intervals (as opposed to the wide prediction intervals for individuals or groups).

Applications and limitations of the exposure-response relationship

According to the EU Position Paper, which also recommends the exposure–response relationships presented here, they are only to be used for aircraft, road traffic and railway noise and for assessing long-term, stable situations *(12)*. They can be utilized for strategic assessments, in order to estimate the effects of noise on populations in terms of annoyance. They are not applicable to local, complaint-type situations or to the assessment of the short-term effects of a change of noise climate. The curves have been derived for *adults*. The curves are not recommended for specific sources such as helicopters, low-flying military aircraft, train shunting, shipping, or aircraft on the ground (taxiing) *(12)*.

Conclusions

Compared to other effects of environmental noise and also compared to effects of environmental factors in general, there are relatively many data directly obtained from exposed humans in the field from which exposure–response relationships for noise annoyance could be derived. It appears that, with the increasing effort on noise mapping, more and better noise exposure data will become available so that, by combining them with the relationships, the prevalence of annoyance can be estimated. The third ingredient for estimating the burden due to environmental noise appears the most difficult. It is hard to weigh "annoyance" and it is difficult to relate it to existing weighted outcomes. We used the limited data on the weights available, giving the indication that about 0.5 million DALYs are lost yearly among the urban population in EU countries owing to the occurrence of noise annoyance.

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7. CONCLUSIONS

Lin Fritschi
A. Lex Brown
Rokho Kim
Dietrich Schwela
Stelios Kephalopoulos

Environmental noise: a public health problem

Environmental noise, also known as noise pollution, is among the most frequent sources of complaint regarding environmental issues in Europe, especially in densely populated urban areas and residential areas near highways, railways and airports. In comparison to other pollutants, the control of environmental noise has been hampered by insufficient knowledge of its effects on humans and of exposure–response relationships, as well as a lack of defined criteria. In 1999, WHO published its *Guidelines for community noise (1)*.

The European Parliament and Council adopted Directive 2002/49/EC of 25 June 2002 *(2)* with the main aim of providing a common basis for tackling noise problems across the EU. This Directive defines environmental noise as unwanted or harmful outdoor sound created by human activities, including noise from road traffic, railway traffic airports and industrial sites, and focuses on three action areas: the determination of exposure to environmental noise through noise mapping, based on common assessment methods; the adoption of action plans by the Member States based on noise-mapping results; and public access to information on environmental noise and its effects.

Among the various effects of environmental noise, health effects are a growing concern of both the general public and policy-makers in the Member Status in Europe. Most of the assessments performed so far to evaluate the impact of environmental noise have been based on the annoyance it causes. Its consideration as a public health problem with measurable health outcomes has been limited *(3)*.

In 2009, WHO published the *Night noise guidelines for Europe (4)*. This publication presented new evidence of the health damage of nighttime noise exposure and recommend threshold values that, if breached at night, would threaten health. An annual average night exposure not exceeding 40 dB outdoors is recommended in the guidelines.

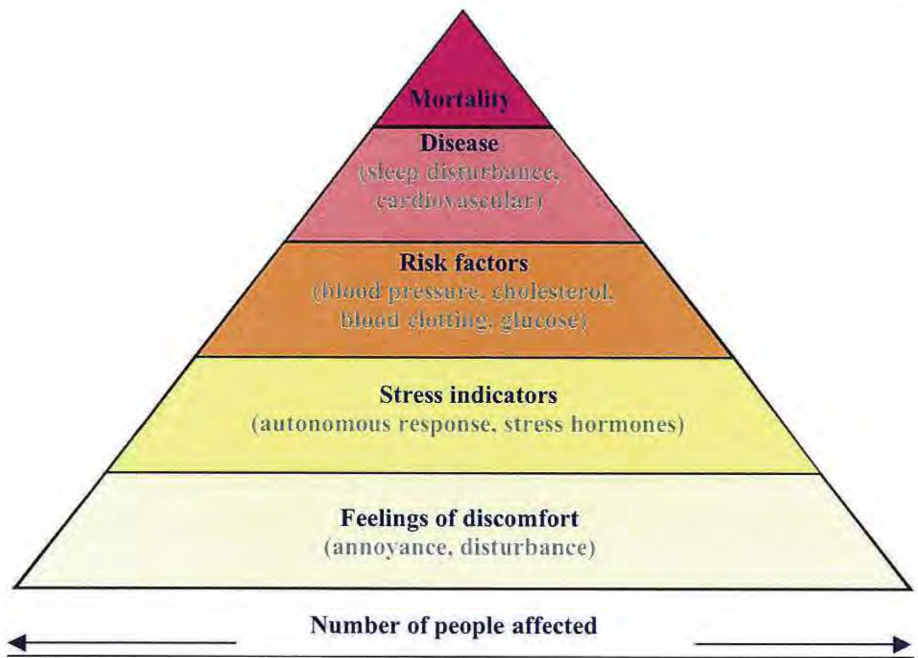
Considering the scientific evidence on the threshold of night noise exposure indicated by L_{night} as defined in Directive 2002/49/EC, a L_{night} value of 40 dB should be the target of the night noise guidelines to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly. A L_{night} value of 55 dB is recommended as an interim target for countries that cannot follow night noise guidelines in the short term for various reasons and where policy-makers choose to adopt a stepwise approach. These guidelines can be considered an extension to the previous WHO *Guidelines for community noise (1)*.

Over the past few years, the working group of experts convened by the European Centre for Environment and Health, Bonn Office and supported by the Joint Research Centre of the European Commission, has collaborated to estimate the burden of disease from environmental noise, using available evidence and data to inform policy-makers and the public about the health impacts of noise exposure in Europe. The chapters in this publication contain the summary of synthesized reviews of evidence on the relationship between environmental noise and specific health effects. Following the EBD methodology of WHO, the health impacts of environmental noise were estimated using exposure–response relationships, exposure distribution, background prevalence of disease and DWs. For each chapter on specific health outcome, a case study is provided. Policy-makers and their advisers can use these chapters as good practice guidance for the process of quantifying specific health risks of environmental noise.

Effects of environmental noise on selected health outcomes

The severity of health effects due to noise versus the number of people affected is schematically presented by Fig. 7.1. Annoyance, sleep disturbance, cardiovascular disease, cognitive impairment, hearing impairment and tinnitus were initially selected by the working group as health outcomes related to environmental noise.

Fig. 7.1. Severity of health effects of noise and number of people affected



Source: Babisch *(3)*.

Sufficient evidence was available to perform calculations of burdens of such outcomes as annoyance, sleep disturbance and cardiovascular disease. The epidemiological evidence was not as sufficient but was still enough for assuming the relationship of environmental noise to cognitive impairment and tinnitus. The epidemiological studies linking hearing impairment to environmental noise exposure are so sparse that any generalization can be considered exploratory and speculative. Therefore, following the recommendations of the peer-reviewers, the chapter on hearing impairment was not included in this publication.

Cardiovascular disorders

The noise indicators used for noise mapping in the EU can – in principle – be used for a quantitative risk assessment regarding cardiovascular risk if exposure–response relationships are known. Only two end-points – hypertension and ischaemic heart disease – should be considered at this stage. If necessary, different exposure–response curves could be used for different exposures. The noise indicator L_{den} may be useful for assessing and predicting annoyance in the population. However, non-weighted day and night noise indicators may be more appropriate for health-effect-related research and risk quantification.

Cognitive impairment

Scientific evidence indicates the adverse effects of chronic noise exposure on children's cognition. There is no generally accepted criterion for quantification of the degree of cognitive impairment into a DW. However, it is possible to make a conservative estimate of loss in DALYs using the methods presented in this chapter. It is important to consider the assumptions, uncertainties and limitations of the methods when interpreting the estimated values of EBD.

Sleep disturbance

Although self-reported sleep disturbance may not reflect the total impact of night-time noise on sleep, it is the effect for which exposure–response relationships on the basis of L_{night} are available for the most important noise sources. Furthermore, while it is hard to weigh self-reported sleep disturbance, it may be even harder to assign a DW to physiological changes indicating a certain degree of sleep fragmentation. Now that exposure data from noise mapping will become available as well as the exposure–response relationships, the prevalence of self-reported sleep disturbance can be estimated.

Tinnitus

There is a method to estimate burden of tinnitus from environmental noise based on expert opinion, which will be useful as a starting point using conservative assumptions and approaches.

Annoyance

There are relatively many data directly obtained from exposed humans in the field from which exposure–response relationships for noise annoyance could be derived. It is hard to weigh "annoyance" and it is difficult to relate it to existing DW values. However, if the national and local authorities are willing to take into account the most common complaints of environmental noise, they could assign an acceptable DW value to annoyance, and estimate EBD accordingly.

Estimated DALYs for western European countries

It is estimated that DALYs lost from environmental noise in the EU countries are 60 000 years for ischaemic heart disease, 45 000 years for cognitive impairment of children, 903 000 years for sleep disturbance, 21 000 years for tinnitus and 587 000 years for annoyance. Sleep disturbance and annoyance mostly related to road traffic noise comprise the main burdens of environmental noise in western Europe. If all of these impacts are considered together, the interval estimate would be 1.0–1.6 million DALYs.[9] The total burden of health effects from environmental noise would be greater than one million years in western Europe, even with the most conservative assumptions that avoid any possible duplication.

Uncertainties, limitations and challenges

The process of risk assessment involves the gathering, synthesizing and interpretation of available evidence. The EBD process, as applied by WHO, is one way of synthesizing this evidence in a standardized manner. EBD methods depend on the availability of data, information, and specific assumptions. To obtain valid and reliable estimates of EBD, good data are needed on the distribution of exposure, on outcomes and on the exposure–response relationship. In the European region, more and better data are available on the distribution of environmental noise, and it is expected that the process of ongoing implementation of EU Directive 2002/49/EC will provide higher quality data in standardized formats comparable between the countries. Regarding outcomes, high-quality data are available for some (e.g. cardiovascular disease) but not for others (e.g. tinnitus). Established exposure–response relationships exist for annoyance, sleep disturbance (subjective), cognitive impairment (children) and cardiovascular disease.

Selection of health effects

Unfortunately, the quality and the quantity of the evidence and data are not the same across the different health outcomes. Other than for cardiovascular disease, obtaining prevalence estimations for the conditions discussed in this publication posed some difficulties. Most of the subclinical conditions are not recorded in routine mortality and morbidity statistics. For tinnitus, the proportion caused by leisure noise rather than occupational noise was difficult to estimate. And conditions such as cognitive impairment in children, sleep disturbance and annoyance are difficult to characterize, let alone estimate the proportion caused by environmental noise. Nevertheless, this publication brings together the best literature and available data and provides transparent justifications of the estimates using conservative assumptions.

Some other outcomes have been suggested as being associated with environmental noise, including hearing impairment, psychiatric conditions such as depression and anxiety, next-day effects of sleep disturbance such as motor accidents. As more evidence accumulates on whether these conditions are indeed associated with environmental noise, further refinements of the estimates in this volume can be made.

Noise exposure indicators

The EU adopted harmonized noise metrics across its Member States: L_{den} to assess annoyance and L_{night} to assess sleep disturbance *(1)*. These metrics are used for strategic mapping of exposure in the EU Member States and are common across all transport sources and other sources of environmental noise. The quality of the exposure data produced through the first round of strategic noise maps in EU may not be optimal in terms of validity and reliability. This will have an unavoidable impact

9 The extent to which years lost from different effects are additive across different outcomes is unclear. The different health outcomes might have synergistic rather than antagonistic when the combined effects occur in a person. Therefore, it would be a conservative approach to add the DALYs of different outcomes not considering synergistic effects.

on the accuracy and precision of any risk assessment using these exposure data. With the full implementation of Directive 2002/49/EC, L_{den} and L_{night} are widely accepted as standard indicators of noise exposure in Europe *(6)*. Many previous studies used other metrics that can be converted to L_{den} and L_{night} with some assumptions. However, this conversion from old to new indicators will contribute to the uncertainties of the estimate.

Exposure-response relationships

Although the exposure–response relationships presented in this publication are based on the available evidence at the time of the working group meetings, there are uncertainties especially when they are derived from limited numbers of studies. It should be noted that the exposure–response relationships will need to be updated using the results of future studies.

Confounding factors and effect modifiers

Most epidemiological studies are prone to bias if confounding factors are not properly controlled by design or statistical methods. Confounding factors include age, gender, smoking, obesity, alcohol use, socioeconomic status, occupation, education, family status, military service, hereditary disease, medication, medical status, race and ethnicity, physical activity, noisy leisure activities, stress-reducing activities, diet and nutrition, housing conditions (crowding) and residential status. Future epidemiological research will have to consider effect modifiers (vulnerable groups, sensitive hours of the day, coping mechanisms, different noise sources, etc.) as well as potential confounding factors.

Combined exposure to noise, air pollution and chemicals

The health impacts of the combined exposure to noise, air pollutants and chemicals are rarely considered in epidemiological studies. Combined exposures occur, for example, when people are exposed to road traffic where noise and air pollution co-exist. The stressors that might be considered in the context of combined exposure with noise include: indoor air pollutants (environmental tobacco smoke, volatile organic compounds), outdoor air pollutants (particulate matter, carbon monoxide, sulphur dioxide, nitrogen dioxide), asphyxiants (carbon monoxide, hydrogen cyanide), solvents (xylene, styrene, toluene, benzene, etc.), heavy metals (lead, mercury), pesticides (organophosphates), variables related to housing (biological agents), and vibration.

An international workshop organized by the Joint Research Centre of the European Commission in cooperation with EEA and WHO in 2007 *(7)* concluded that the best knowledge on the health effects due to combined exposure to noise and solvents or heavy metals exists in occupational environments. However, there are few studies showing combined effects of noise and air pollutants in urban environments. Some data exist only on respiratory disorders caused by combined effects of noise and outdoor air pollutants, balance disorders caused by occupational exposure to noise and solvents, and effects on human growth caused by combined effects of noise and heavy metals. The workshop concluded that a substantial amount of research is needed to determine the health effects of combined exposure to environmental noise and other environmental pollutants.

Total burden from environmental noise

In general, care should be taken to avoid "double counting" when DALYs from different outcomes are totalled to estimate an overall burden of disease from an environmental risk factor. In the case of environmental noise, this should not be a big problem. For example, the burdens of annoyance during the daytime and sleep disturbances at night can be safely added up. Nevertheless, because of the different qualities of the evidence underlying the different EBD calculations, special care should be taken when making direct comparisons between DALYs for different outcomes.

If DALYs caused by environmental noise are compared with those from other pollutants, it is important to take into account the approximations and assumptions made in the calculation process. More information on these issues has been summarized in documents on the methodology of EBD *(8)*.

Health inequality and vulnerable groups

Some noise exposures may be worse for some subgroups than for others. Issues such as the lower housing prices near noisy roads mean that the effect of noise is not uniformly distributed throughout the population. Except for a chapter on cognitive impairment in children, this publication did not explore the additional burdens in potentially vulnerable subgroups such as older people and lower socioeconomic groups.

Uses of this publication

The evidence and methods for quantifying the health impacts of environmental noise presented and illustrated in this volume can be used by policy-makers, planners and engineers to measure the magnitude of health problems related to noise pollution in society today. Because many European countries have already produced strategic noise maps and action plans on noise control according to Directive 2002/49/EC *(2)*, the good practices of risk assessment presented in this volume can be readily applied to the national and local situations in many countries. In countries where all the required data for a complete calculation of burden of disease may not be available, this publication demonstrates a range of options that can be used to make estimations according to which components of the risk assessment are accessible.

Although this publication has been prepared with a European focus in terms of policy, available data and legislation, the processes of risk assessment illustrated here can also be used outside Europe as long as the assumptions, limitations and uncertainties described in the various chapters are carefully taken into account.

The effects of neighbourhood noise were not addressed in this publication as they need to be better characterized and measured in future studies. In addition, the effects of leisure noise were not considered because there is very little information available on the prevalence of voluntary exposure to leisure noise through amplified music at concerts and other public events and through personal music players.

Noise and the Parma Declaration on Environment and Health

There is overwhelming evidence that exposure to environmental noise has adverse effects on the health of the population. Recognizing the special need to protect children from the harmful effects of noise, the Parma Declaration adopted at the Fifth Ministerial Conference on Environment and Health *(9)* called on all stakeholders to work together to reduce the exposure of children to noise, including that from personal electronic devices, from recreation and traffic (especially in residential areas), at child care centres, kindergartens and schools and in public recreational settings. This publication provides an evidence base for the future development of suitable guidelines on noise by WHO, as was urged by the Member States in the Parma Declaration. The evidence on burden of disease presented here will inform the new European health policy, Health 2020, which will be presented for endorsement at the WHO Regional Committee for Europe in 2012.

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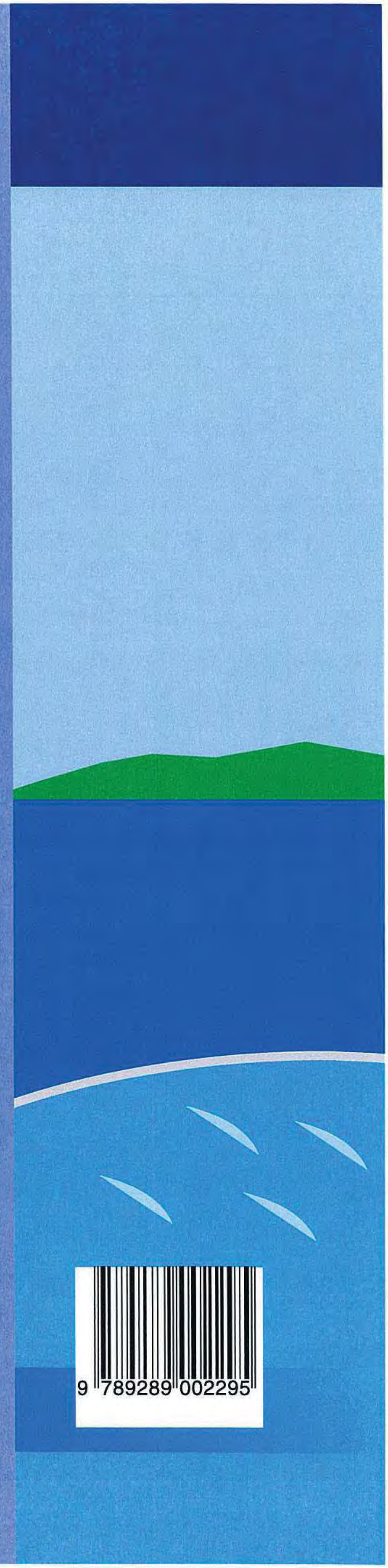
Burden of Disease from Environmental Noise

The health impacts of environmental noise are a growing concern among both the general public and policy-makers in Europe. This publication provides technical support to policy-makers and their advisers in the quantitative risk assessment of environmental noise, using evidence and data available in Europe. It contains the summary of synthesized reviews of evidence on the relationship between environmental noise and specific health effects, including cardiovascular disease, cognitive impairment, sleep disturbance, tinnitus, and annoyance. For each outcome, the environmental burden of disease methodology, based on exposure–response relationship, exposure distribution, background prevalence of disease and disability weights of the outcome, is applied to calculate the burden of disease in terms of disability-adjusted life-years. The results indicate that at least one million healthy life years are lost every year from traffic-related noise in the western part of Europe. Owing to a lack of exposure data in south-east Europe and the newly independent states, it was not possible to estimate the disease burden in the whole of the WHO European Region. The procedure of estimating burdens presented in this publication can be used by international, national and local authorities in prioritizing and planning environmental and public health policies.



World Health Organization
Regional Office for Europe

Scherfigsvej 8, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 39 17 17 17. Fax: +45 39 17 18 18. E-mail: contact@euro.who.int
Web site: www.euro.who.int

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November 24, 2014

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis-Monthan Air Force Base, Arizona 85707

From: Joseph Watkins
2726 East Malvern Street
Tucson Arizona 85716

To the Colonel responsible for Installations & Mission Support:

This letter is in response to the Draft *Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona.*

This response begins by noting that I could find nowhere in the Draft Environmental Assessment a response to the issues raised in my letter concerning the 2012 Draft Environmental Assessment. Consequently, this letter is enclosed with a request that the issues be taken seriously.

A fundamental requirement of civil society is that public actors act ethically. In the case of the presentation of data analysis in the making of public policy, American government officials, in this case military officials, have the distinct advantage of having these principles described in a straightforward and understandable manner in *Ethical Guidelines for Statistical Practice* from the American Statistical Society.

As outlined by my previous correspondence, “the Environmental Assessment falls well short of the ethical standards for statistics and society”. Indeed, the 2014 Draft Environmental Assessment seems to take a step back from the point of view of ethics.

In the 2012 Draft, the Air Force stated that it would rather not make the effort to base an analysis on the 1978 circumstances. In this Draft, it takes as the statement of the *status quo ante* the average of activities from 2007 to 2013. The question of how a baseline that describes the situation before the change in mission is based on an average of activity during this change in mission defies logic. Moreover, the draft makes no attempt to show that such a choice does not prejudice the outcome. Recall that professionalism in the Ethical Guidelines calls for methods that “guard against the possibility that a predisposition by investigators or data providers might predetermine the analytic result.” The assertions on page 2-5 concerning their unwillingness to return to the 1978 Baseline do not absolve them of the ethical responsibility to choose a methodology that does not predetermine the result. Indeed, the lack of transparency is so fundamental, that we cannot ascertain, even under the clearly unprofessional standards of analysis that the addition of a very small number of planes might change the conclusion on no impact significant

One troubling source of analysis is contained in

Since the exact number or type of aircraft that would participate in the Total Force Training in future years cannot be determined with a required level of certainty, the representative aircraft expected to participate are used for analysis in this revised EA. (2-10 lines 11-13)

This states that the Air Force will use an anticipated average activity to base its analysis of impact, but does nothing to limit the Air Force from exceeding this level by any amount, no matter how large. Standard statistical practice is to make a clear definition of "significant" and design analyses that are *conservative*. In this case, this would call for using the worst case reasonably possible for noise and accident potential and show that this case has no significant impact under a well-defined criterion. Again, deviating from this approach would be considered unethical by the standards of practicing statisticians.

Moreover*, briefings would ensure aircrew understanding and expectation to comply with the procedures and requirements* (2-12 lines 16 and 17) makes it clear that even adherence to the procedures that are used in the analysis are not made compulsory and thus the Air Force can not ethically assert that even their worst case scenario can be guaranteed.

So, in summary, the Air Force chooses a baseline without giving a technical justification for moving from the situation before Operation Snowbird, uses an average of the time when Operation Snowbird was in effect to determine the impact of a renamed Operation Snowbird, bases its analysis on an anticipated average that does not guarantee a maximal level of impact, expects, but does not ensure, that future operations at Davis-Monthan Air Force Base will adhere to the procedures given in the Draft, and states with certainly the impact of the Total Force Training Mission will have no significant impact while noting that it has little certainty in what that Mission might entail. Indeed, the report admits as much in stating, *"Since the exact number or type of aircraft that would participate in the Total Force Training in future years cannot be determined with a required level of certainty… ."* (2-10 line 12). Such a practice in computer science is commonly called "garbage in, garbage out".

Finally, the phrase "Total Force Training" was initiated in the Draft and so we are left with the oxymoron that the no action alternative *Continuation of Total Force Training at 2009 Levels* (2-4 line 13) calls for the continuation of a mission that does not yet exist.

For the analysis, I could not find where any of the listed of the shortcomings described my previous correspondence had been addressed. Meeting such standards is considered routine practice in data analysis. Their omission constitutes breaches of the *Ethical Guidelines*.

The analysis is based on a suite of modules called Noisemap. No reference for the scientific basis for computing the impact of noise is given and the latest version I could find online is 1990 based on long since outdated hardware. However, the 1978 Schultz curve (Appendix C, page 11) is displayed with the statement of percent of communities annoyed (even though Schultz talks about individuals annoyed). Insufficient detail is provided to assess the quality of analysis. However, it appears that the analysis, remarkably completed during a single day, May 12, 2014,

- assumes exactly one scenario in which every plane flies exactly on the flight path,
- fails to include any uncertainty in the output even though input is subject to uncertainty. In engineering terms, there is no effort to determine the propagation of error,
- details in the analysis are not present to the degree necessary to reproduce results. Collect data, validate data, analyze data, draft report, and write report is not a methodology. The methods section should have sufficient detail that a person of skills comparable to the preparers of the report would be able to assess the quality of the work,
- techniques are based on science and software that are decades old in areas that are active areas of research. Indeed, the Department of Defense made such an admission in 2009 with its publication *Community Annoyance Caused by Noise from Military Aircraft Operations*.

I have been involved in dozens of scholarly papers, responsible for the quantitative modeling and data analysis. The research team routinely challenges itself to high standards, modern methods and clarity of exposition based on the desire that our contributions be as transparent, as truthful and as widely accessible as possible. This approach is not evident in the Draft and I remain astonished as a scholar and disturbed as a citizen to see such low standards. When asked to serve as a reviewer of a scholarly contribution, I routinely see the collaboration written into the exposition with the desire to be straightforward to the community who will benefit from the results of the research. Typically, the review contains several statements that may not be easy to address with the goal to further the clarity and the quality of the work. Occasionally, the manuscript received for review has shortcomingsso rife that any attempt to list the problematic aspects is futile, addressing the top layer of deficiencies serves mainly to expose the next layer. The authors must start afresh, beginning by adding the necessary competent collaborators. This Draft is such a manuscript. For an arm of the government of the United States to present this as a credible analysis should not be tolerated either by a government or its citizens.

Respectfully submitted,

Joseph Watkins

To: Gary D. Chesley, Colonel, USAF
Deputy Director, Installations & Mission Support

From: Joseph Watkins
2726 East Malvern Street, Tucson AZ 85716

Re: Draft OSB EA Comment Submittal on Operation Snowbird,
Davis-Monthan Air Force Base

Date: September 10, 2012

Dear Colonel Chesley,

I have taught statistics classes for more than 15 years. At a certain point early in the semester of an introductory course, we discuss the ethical issues associated with the presentation and analysis of data. The sources of our discussion are provided by professional statistical societies, notably, the *Ethical Guidelines for Statistical Practice* from the American Statistical Society and the International Statistical Institute *Declaration on Professional Ethics*. I have enclosed a copy of these two valuable documents so that you will have ready access to them.

The Environmental Assessment for the Proposed Update and Implementation of the National Guard Bureau Training Plan 60-1 in Support of Operation Snowbird Davis-Monthan Air Force Base, Arizona has a Finding of No Significant Impact (FONSI). Because the Air Force has made a finding that is in its own interest, the report of such a finding necessitates heightened scrutiny. Let's begin with some excerpts from the Ethical Guidelines for Statistical Practice to aid us on our evaluation of the quality of the statistical work in the Environmental Assessment.

I. PREAMBLE
B. Statistics and Society

Scientific and engineering research in all disciplines requires the careful design and analysis of experiments and observations. To the extent that uncertainty and measurement error are involved-as they are in most research-research design, data quality management, analysis, and interpretation are all crucially dependent on statistical concepts and methods. Even in theory, much of science and engineering involves natural variability. Variability, whether great or small, must be carefully examined for both random error and possible researcher bias or wishful thinking.

Statistical tools and methods, as with many other technologies, can be employed either for social good or evil. The professionalism encouraged by these guidelines is predicated on their use in socially responsible pursuits by morally responsible societies, governments, and employers. Where the end purpose of a statistical application is itself morally reprehensible, statistical professionalism ceases to have ethical worth.

II. ETHICAL GUIDELINES
A. Professionalism

1. Strive for relevance in statistical analyses. Typically, each study should be based on a competent understanding of the subject-matter issues, statistical protocols that are clearly defined for the stage (exploratory, intermediate, or final) of analysis before looking at those data that will be decisive for that stage, and technical criteria to justify both the practical relevance of the study and the amount of data to be used.

2. Guard against the possibility that a predisposition by investigators or data providers might predetermine the analytic result. Employ data selection or sampling methods and analytic approaches that are designed to ensure valid analyses in either frequentist or Bayesian approaches.

3. Remain current in dynamically evolving statistical methodology; yesterday's preferred methods may be barely acceptable today and totally obsolete tomorrow.

C. Responsibilities in Publications and Testimony

2. Report statistical and substantive assumptions made in the study.

3. In publications or testimony, identify who is responsible for the statistical work if it would not otherwise be apparent.

5. Account for all data considered in a study and explain the sample(s) actually used.

6. Report the sources and assessed adequacy of the data.

7. Report the data cleaning and screening procedures used, including any imputation.

8. Clearly and fully report the steps taken to guard validity. Address the suitability of the analytic methods and their inherent assumptions relative to the circumstances of the specific study. Identify the computer routines used to implement the analytic methods.

12. Report the limits of statistical inference of the study and possible sources of error. For example, disclose any significant failure to follow through fully on an agreed sampling or analytic plan and explain any resulting adverse consequences.

15. Write with consideration of the intended audience. (For the general public, convey the scope, relevance, and conclusions of a study without technical distractions. For the professional literature, strive to answer the questions likely to occur to your peers.)

With these very basic rules of ethical behavior in mind, let's review just two aspects of The Environmental Assessment.

1. Choice of Baseline

The last broad agreement on airplane operations between the Davis-Monthan Air Force Base and the people who live in the vicinity of the Base was the Environmental Assessment of 1978. Thus, a credible null hypothesis is to take the *status quo* to be the circumstances in 1978. The onus fall on the on the Air Force to show that any alternative choice does not lead to a predetermination of the result of the analysis. Could the Air Force conduct an analysis using a 1978 dateline? Indeed, it states that it could, but would rather not. To quote from the report:

In order to provide a valid baseline for comparison, the Air Force would essentially be forced to rewrite the 1978 EA to be able to compare the impacts of proposed operations with type, nature, and quality of impacts occurring in 1978. The Air Force has determined that recreating a 34-year-old environmental baseline upon which to make present-day decisions would be unhelpful and not pragmatic. (page 2-2, lines 19 through 24).

The documents adds

NEPA is a forward-looking statute in which agencies are not required to catalogue or exhaustively list and analyze all individual past actions. (page 2-2, lines 10 through 12)

as an argument against using the 1978 baseline. However, no request was made to make such an exhaustive list or analysis. The request was to use a 1978 baseline. In addition, the choice of this baseline does not interfere with NEPA's charge to look forward.

It seems that the report is based on a 2009 baseline and uses information from a 2007 report. I could not find a well-explained justification for this choice of baseline. In addition, I could not even locate the 2007 report. This combination is particularly troubling. If the activities connected with Operation Snowbird are intensifying over time, then without careful explanation, the public will have a distinct impression that the choice of baseline prejudices the outcome particularly when the noise contour maps are based on 2007 data unavailable to the public.

2. Impact of Noise

The finding of no significant impact based on the public annoyance from noise exposure uses the well-cited 1978 study of Schultz. His fitted curve incorporates all forms of transportation noise data and makes no special consideration of the nature of annoyance from military aircraft. More modern methods are provided, for example by Wyle (Noise

Effects and the Affect of Aviation Noise on the Enviroment), who is otherwise cited in this Environmental Assessment. In this study (page 12), the authors note:

Military aircraft flying on Military Training Routes (MTRs) and in Restricted Areas/Ranges generate a noise environment that is somewhat different from that associated with airfield operations. ... To represent these differences, the conventional SEL metric is adjusted to account for the "surprise" effect of the sudden onset of aircraft noise events on humans with an adjustment ranging up to 11 dB above the normal Sound Exposure Level. (Stusnick, et al. 1992).

Thus, the analysis in the document fails to use at least one method that is more powerful in finding a significant impact from noise. This is particularly noteworthy in that the increase in flights, minimized by the report to be 7%, are those planes that have the most significant "surprise" effect. Moreover, even though the F-22 is a part of the Preferred Alternative, it is not included in the analyses.

With reference to the ethical guidelines, we note several items:

- No effort was made to demonstrate that the chosen baseline does not predetermine the finding.

- Uncertainties in measurements are never mentioned. For example, we do not see confidence intervals for the estimates.

- Statistical protocols and assumptions are routinely left unexplained. For example, the procedure to move from mishap rates to risk factors in just stated. I could not find a definition of risk factor. In addition, total risk is the accumulation of risks from many sources. The models used to combine risk are absent from the report. For example, if a classical additive model of risk is used, then the Guidelines require an explanation for the failure to use more modern methods. Here is the explanation of methods that I found in the Environmental Assessment:

  The mishap rate is dependent on the number of each aircraft type deployed, the time elapsed since the aircraft type has been in operation, the number of hours flown for each type, and the location of the operations. The mishap rates for OSB at DMAFB were converted to a risk factor for each aircraft type based on the number of hours flown by each aircraft type in OSB. (Page 3-21, lines 19 through 22).

- The contour maps in Section 4 appear with no explanation for the methodology and no reference of the computer program used in determining noise contour lines.

- Alternative methods are not given. The Wyle study gives alternatives for measuring noise more modern than the 1978 Shultz study. Because this method is adversarial to the finding of no significant impact, standard practice in statistics is to explain why such a method is considered inferior.

- The criterion for finding a significant impact is not explained and so the results cannot not be assessed independently.

- Aspects of the data are not sourced. Indeed, the 2007 study does not seem to be public.

- Uncertainties in the data are not explained – risk factors, noise contour lines, and the number of affected individuals are all estimates based on assumptions that must be stated plainly and whose uncertainties need to be described carefully.

- The Air Force has an ethical obligation to make the report accessible to the public and to explain how their methods result in a valid analysis, to explain how data were summarized, and to give the criterion for decision.

- In addition, a significant portion of the public who are impacted by the activities of the Air Force Base are monolingual Spanish speakers and the Air Force has failed to make the report accessible to these residents.

In summary, the Environmental Assessment goes falls well short of the ethical standards for statistics and society and standards of professionalism as articulated in the *Ethical Guidelines for Statistical Practice*. As a consequence, I call for the withdrawal of the Environmental Assessment and for the issuing of a new report in which agreed upon ethical standards form the basis of the study.

Respectfully submitted,

Joseph Watkins

Enclosures:
Ethical Guidelines for Statistical Practice from the American Statistical Society
Declaration on Professional Ethics from International Statistical Institute

From: 355 FW/PA Comments <355FW.PA.Comment@us.af.mil>
Sent: Tuesday, November 25, 2014 8:53 AM
To: CALDER, DONALD W JR GS-13 USAF HQ ACC A7/A7NS; Chris Ingram
Cc: FLORES, ANGELA R GS-13 USAF ACC 355 CES/CEI; DEUTSCH, KARL R GS-12 USAF ACC 355 CES/CEIA; WAKEFIELD, KEVIN L GS-09 USAF ACC 355 CES/CEIE; OSBORNE, CASEY R Capt USAF ACC 355 FW/PA; RANAWEERA, ERIN M 2d Lt USAF ACC 355 FW/PA; DALRYMPLE, NICOLE M GS-09 USAF ACC 355 FW/PA
Subject: 2014 TFT COMMENTS FW: OSB EA Comment Submittal
Attachments: Broadmoor Broadway Village Neighborhood Association Comments, DEA, 2014.docx

-----Original Message-----
From: 355 FW/PA 355th FW Public Affairs
Sent: Tuesday, November 25, 2014 7:40 AM
To: 355 FW/PA Comments
Subject: FW: OSB EA Comment Submittal

-----Original Message-----
From: BBVNA Past President [mailto:pastpresident@broadmoorbroadwayvillage.com]
Sent: Tuesday, November 25, 2014 12:20 AM
To: 355 FW/PA 355th FW Public Affairs
Subject: OSB EA Comment Submittal

Please see attached. Thank you very much.

BROADMOOR-BROADWAY VILLAGE NEIGHBORHOOD ASSOCIA

November 24, 2014

Via electronic mail
ATTN: TFT EA COMMENT SUBMITTAL,
355th Fighter Wing Public Affairs
3405 S Fifth Street,
Davis-Monthan AFB, Arizona 85707.

Re: Environmental Assessment for the Update and Implementation of the Total Force Training Mission for Visiting Units (Operation Snowbird, Multi-Service, and Foreign Military Sales) Davis-Monthan Air Force Base, Arizona

To Whom It May Concern:

This letter from the Broadmoor Broadway Village Neighborhood Association is in response to the solicitation of comments regarding the Draft Environmental Assessment for the Update and Implementation of the Total Force Training Mission of Visiting Units (Operation Snowbird Multi-Service and Foreign Military Sales) at Davis-Monthan Air Force Base in Tucson, Arizona. The BBVNA responded to the solicitation of comments for the Draft Environmental Assessment for the Proposed Update and Implementation of the National Guard Bureau Training Plan 60-1, in Support of Operation Snowbird at Davis-Monthan Air Force Base, issued in July, 2012, as the original version drafted for the same EA. Those comments were separately submitted by our neighborhood representative to the Military Community Relations Committee and by our president, and still apply in regard to this revised version of the DEA. Please review those.

We are concerned with the proposed additional increase in the number of annual sorties, significantly beyond even what was considered the Preferred Alternative in the earlier draft, the inaccurate baseline year, and the obvious discrepancies in the data presented for the annual number of sorties in 2009. In addition, as stated in the DEA, “Each event will typically require between 8 to 12 support aircraft sorties for an expected total of 96 to 144 support aircraft sorties per year. These support aircraft sorties are not counted towards the total amount of training aircraft sorties allowed per event.” That’s an enormous increase in itself. The types of aircraft proposed would allow potential extreme changes in noise levels, to bring in aircraft not only far louder, but lacking the safety record of the A-10, including foreign military jets, such as the

Harrier, which has an abysmal safety record, has been dubbed “the widow maker.” Under the DEA, numerous aircraft are listed, after the legal phrase “including, but not limited to,” so nothing is off limits.

The noise contours are clearly not accurate. The markers do not match where the noise is. This should be corrected.

With the addition of a new runway at Tucson International Airport, increased activities due to drones, Border Patrol, Customs and Immigration, and the other flights out of D-M, we would appreciate a more thorough study and analysis of air traffic over the most densely populated portions of Tucson.

We continue to request that serious consideration be given to flying over the railroad tracks and landing further down the extensive runway, in order to help alleviate noise and other pollution, and better protect the environment, economy, health, safety and welfare of Tucsonans.

Once again, we note that the critical issue of water has not been addressed, though we made that request in our last comments. D-M is a superfund site. We remain concerned about our groundwater, washes and floodplains in Tucson, and the consequences downstream in our neighborhoods. It is important to comply with the requirements of the Clean Water Act and the Safe Water Drinking Act.

Continuing issues regarding a Finding of No Significant Impact involve valid concerns regarding Tucson’s economy and its vital economic contributors, including Tourism and the University of Arizona, values for commercial and residential properties, and the primary reasons that substantially influence decisions about visiting, relocating, establishment of businesses and retirement in our community.

The proposed drastic expansion of night flight is particularly perturbing. Already, there has been steady encroachment in this area, contrary to the Air Installation Compatible Use Zone. Any future contemplated abuse of what should be quiet time merits fuller study and careful analysis, to say the least.

We again request a comprehensive document to address the innumerable of critical issues of significant concern to the Tucson community, provide in-depth research and thorough analysis, and fulfill the need for an Environmental Impact Statement.

Sincerely,

Mary Terry Schiltz
Immediate Past President
Broadmoor Broadway Village Neighborhood Association

ATTN: TFT EA COMMENT SUBMITTAL
355th Fighter Wing Public Affairs
3405 S. Fifth Street
Davis Monthan AFB AZ 85707

Dear Sirs:

I live near Swan and River and I am often bothered by military aircraft flyovers. Even the relatively quiet A10's can be a problem when flyovers are frequent. Doubling the flyovers along with an increase in the number of much noisier aircraft seems like a big step in the wrong direction.

The use of a 24 hour average for the sound readings is extremely inappropriate for this situation. Peak sound levels are the problem, even if very infrequent.

I strongly recommend that the sound impact be revisited in a more meaningful manner.

Sincerely,

Jeff Koloseus
4182 N Saranac Dr
Tucson, AZ 85718