FAA Noise Policy Review Questionnaire

Completed by: Citizens of Ebey's Reserve

and Sound Defense Alliance

Sept 22, 2023

We commend and thank the FAA for extending this opportunity for public input on this matter of grave import. Citizens of Ebeys Reserve (COER; COER Website) and Sound Defense Alliance (SDA; SDA Website) comments on the FAA's survey on the noise exposure (annoyance) threshold are based entirely on military jet practice that residents in the northern Puget Sound area of Washington State, especially Coupeville and Oak Harbor, experience on a frequent to daily basis. Complaints are logged and reported routinely at Quiet Skies Report, as well as by the Navy. COER and SDA represent those citizens and as such, respond to this FAA questionnaire in the active voice of "we" for all of them.

We understand the FAA's has no authority to develop or implement noise policy for the military. However, the military claims to follow FAA rules and policies and insists on using the 65-dB day-night level (DNL) as its threshold for significant noise annoyance because that

is the level the FAA uses. Hence, whatever civilian aircraft noise policy changes are adopted by the FAA, will become relevant to the military. Furthermore, decibels are decibels regardless of whether the source is from civilian or military aircraft.

Hence, although our experience is drawn from military aircraft, our input provided on this survey is as appropriate as input from individuals or groups focused on civilian aircraft.

Just to clarify, our noise exposure is from the Navy's EA-18G "Growler" jets based at Naval Air Station Whidbey Island in Oak Harbor where the Growlers take off and land at Ault Field and where some touch-go field carrier landing practice (FCLP) is conducted (about 2500 bounces per year). The majority of the FCLPs (12,000 bounces) are conducted at Outlying Landing Field in Coupeville, about 10 miles south of Ault Field[1]. The FCLPs are conducted at elevations over rooftops of about 200 to 800 feet producing noise levels of 110-120 dBA under the path JGL Acoustics Report (see Table 1). Between the two airfields there

[1] Given the low elevation, the FAA does exert a measure of control over the Navy's FCLPs. At the outlying field in Coupeville, the area surrounding the practice loop operates under a Special Use Airspace permit, Alert Area 680.

are over 20,000 residents within a mile of the FCLP loop[2].

Responses to Select FAA Questions

2.a. What elements of aircraft operations (e.g., en-route, takeoff, landing) should the noise metric evaluate and disclose? Should the FAA use this information to make decisions or disclose to the public noise impacts? Please explain your reasoning.

The loudest components of flight are takeoff and landing, which includes all of a touch-and-go circuit. Those flight elements should be the highest priority for noise policy consideration to guide decision-making.

2.b. What interests or concerns do communities in the vicinity of airports have? How can these concerns be addressed using noise metrics? What noise metrics would address these concerns? Please explain your reasoning.

2.c. What interests or concerns do overflight communities (28) have? How can these concerns be addressed using noise metrics? What

---

[2] Derived via EJScreen, an environmental screening and mapping tool developed by the Environmental Protection Agency based on U.S. Census Bureau data (https://www.epa.gov/ejscreen).

noise metrics would address these concerns? Please explain your reasoning.

Questions 2.b and 2.c differ only in the sense that noise in the vicinity of the flight path is generally understood to be less than noise in communities more or less directly under the takeoff/landing or touch-go paths. Exceptions understood, the real issue is not necessarily proximity, but rather the loudness experienced by any community. That is, aircraft noise is a function of elevation, distance from the aircraft, and aircraft type[3]. Hence, our thoughts on these two questions are combined into a consideration of unwelcome and debilitating noise that interferes with life, regardless of whether the community is under, somewhat adjacent to, or more disparate from the flight path.

Community officials have a responsibility to promote the common good and protect the public well-being, so of course noise impacts are not only of fundamental

[3] An aircraft at 200' AGL producing a sound of 118 dBA on the ground directly under the aircraft will be 77 dBA at 1 mile away (41 dBA difference), whereas were the same aircraft at 5000' noise directly under would be 88 dBA versus 81 dBA at 1 mile (6 dBA difference). Hence, increased altitude decreases rate of attenuation. https://media.defense.gov/2019/Feb/01/2002085194/-1/-1/1/CHAPTER%203%20-%20AFFECTED%20ENVIRONMENT.PDF (see Table 3.1-2)

interest and concern, but are the very essence of their charge.

Extreme noise, like that during Growler FCLPs in our area, ignites trauma in veterans with PTSD, compromises at-home businesses, interrupts classroom education and learning, interferes with homework, diminishes cognitive function, aggravates dissociative reactions in autistic and special-needs children, disrupts sleep, and is detrimental to fetal development. And if all that isn't bad enough, extreme noise affects psychological well-being and diminishes and intimidates at-home livability, in some areas to such an extent that residents after short tenures are forced to relocate, creating dysfunctional turnover neighborhoods.

> *3. DNL. What views or comments do you have about the FAA's core decision making metric, DNL? How would these views regarding DNL be resolved if the FAA employed another noise metric (either in addition to, or to replace DNL) or if the FAA calculated DNL differently?*

As internationally respected acoustic expert, Dr. Sandy Fidell, put it, "the [DNL] criterion of the

‘significance’ of noise impacts fails to reflect modern scientific information about the effects of aircraft noise on residential populations.” (Fidell on DNL).

We support this FAA survey and its willing consideration of more effectual policy reflecting 60 years of scientific advancement. The framing paper, however, seems to minify policy, stating, “No policy change on its own will reduce the levels of aviation noise on the ground.” True enough, but policy does act as a political catalyst creating the incentive and logistical actions needed to reduce noise impacts.

The challenge here is to find a better way to understand and relate the impacts of noise on life. The 65 DNL metric is basically a dinosaur that the FAA has clung to because change would create uncomfortable hurdles. However, an agency’s reluctance to accommodate changes and adapt policy consistent with the times is not really good for the country or the agency. It just compounds the problem to come out from under the rug eventually, increasing costs and exacerbating interim impacts. Hence, though overdue, our suggestion is to update the broken DNL metric and threshold, and adopt separate metrics for acoustic and non-acoustic health.

4. Averaging. DNL provides a cumulative description of the noise events expected to occur over the course of an entire year averaged into a representative day, described as an Average Annual Day (AAD).

4.a. Do you believe an AAD is an appropriate way to describe noise impacts? Please explain why or why not.

No. We strongly believe AAD is not appropriate unless aircraft noise occurs on all days of the year. Where aircraft operations occur on fewer days, then the AAD is biased low; the more no-fly days, the greater the bias. In those cases, the AAD artificially diminishes the impact reaction, making it appear less than it is.

The other side of that coin is the ABD (average busy day), which is average DNL for just those days when flying occurs. It is a true representation of the "annoyance" on the days of flying, but it discounts non-noise days and therefore is biased high when trying to put a full year of noise into perspective. We believe there is a fairly reasonable way around those high/low biases, which we present in question 4.b.

4.b. If not, what alternative averaging schemes to AAD should be considered and why? What information would the use of an alternative averaging scheme capture that AAD does not?

Because of ADD frequently biasing low and ABD biasing high, we suggest using an average the two — call it the normalized average day (NAD) DNL. Where the difference between the ADD and ABD is very small due to very few no-fly days, the NAD will be close to both ADD and ABD. If the AAD and ABD are widely different, the NAD will tend to cancel out the extremes and produce a more realistic and fair index of the annoyance effects. It also maintains established use of DNL, which is pretty much baked into common use, even though current pubic understanding and acceptance is relatively low.

That said, we believe DNL, regardless of how it is averaged, should be largely limited to its original purpose—i.e., indexing aggravation and annoyance. Even though there is a physiological link between annoyance and certain health outcomes, we believe there are better metrics to evaluate health impacts, metrics with fewer confounding variables inherent in the DNL, which we examine in question 5.

5. Decisionmaking Noise Metrics. The FAA currently uses DNL as its primary decisionmaking metric for actions subject to NEPA and airport noise compatibility planning studies prepared pursuant to 14 CFR part 150.

5.a. Should different noise metrics be used in different circumstances for decisionmaking?

Whether the FAA should use non-DNL metrics in its decision-making depends very much on what decisions are under consideration. If, for example, the decisions address auditory or non-auditory human health, then yes, a metric other than DNL should be considered (as we discuss below in 5.b; same for wildlife). And there are specialized situations that may require more unique and targeted policy other than DNL, e.g., protecting fetal development or the solitude and sanctity of our national parks and wildlife refuges.

5.b. If the answer to Question 5.a. is "yes," please identify: the metric, the information it provides that DNL does not, and explain when and how it should be employed by the FAA in its system (e.g., should the FAA use a noise metric other than DNL to evaluate noise exposure in quiet settings, such as national parks, national wildlife and waterfowl refuges, etc.)? Should this metric be used when the FAA is making decisions that affect noise in these settings? Should this metric be used alone or in combination with another metric?

A 24-hour 65-dBA DNL can be derived from wide variations of the flyover loudness and frequency terms used in the DNL calculation. Paul Schomer, past Standards Director, Emeritus, Acoustical Society of America explains it this way: "A *65 DNL for a year is 91 dB if it comes in one day, 140 dB in 1 second, and 170 dB in 1 ms.*"

As another example (Oregon Initiative) a noise event of 100 dB for 30 seconds where the ambient sound level is 50 dB for the rest of the 24-h day produces a DNL of 65.5, but had there been 10 such events the DND would have been 75.4. The question here is whether the 15% increase in the DNL provides an adequate distinction for a 900% increase in flyovers.

Put still another way, for a 24-h DNL of 65, we ask which is worse: A day with some very loud events or a day with more but fewer loud events? The health consequences may be quite different, but the 65 DNL does not provide a way to parse that out. If there is a difference in the biological response, it is nullified and hidden by the one-size-fits-all DNL cover-up. So, while DNL may continue to be a reasonable metric to index annoyance (if modified to an average of ABD and

AAD), other metrics seem better suited to address the health ramifications of noise.

Indeed, as stated by U.S. Army Center for Health Promotion and Preventive Medicine[4], "*although the DNL has been emphasized by the DoD and especially the Army as the primary noise exposure metric, this metric applies to community annoyance and is seldom related to behavioral or reproductive effects of humans or wildlife.*"

The metric that seems to be more efficacious for assessing noise impacts on health is "dose." Because dose quantifies just the health-damaging noise it is more definitive than DNL in revealing health impacts from noise exposure. It removes non-damaging noise from influencing and confounding the damage analysis[5].

---

[4] U.S. Army Center for Health Promotion and Preventive Medicine *Ecological Risk Assessment Framework for Low-Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft.* January 2000. Rebecca A. Efroymson (Oak Ridge National Laboratory), Winifred Hodge Rose and Sarah Nemeth (U. S. Army Construction Engineering Research Laboratory), and Glenn W. Suter II (U. S. Environmental Protection Agency). Research sponsored by the Strategic Environmental Research and Development Program of the U. S. Department of Defense under Interagency Agreement 2107-N218-S1 under contract DE-AC05-00OR22725 with UT-Battelle, LLC. Publication No. 5010, Environmental Sciences Division, ORNL (see page 28). https://www.researchgate.net/publication/252522677

[5] Non-hurtful noise can be included—e.g., as H(1/N), where H = total of hurtful noise ≥85 dB in one day (in min), and N = [1/(1440 min - H)]—but it is not necessary and needlessly complicates understanding, which should be of paramount interest.

For example, U.S. Fish and Wildlife Service recognizes the disturbance threshold for the listed marbled murrelet as 92 dBA. Because DNL mushes a lot of non-noise time with the impactful noise time, the DNL provides no insight on how often murrelets may experience life-disrupting 92-dBA overflights. Hence, the Service ignores DNL and focuses on the number of exposures ≥92 dBA that murrelets may experience per day and per year.

Allowable Unprotected Sound Level (dBA)	Duration (hours/day)	Allowable Unprotected Sound Level (dBA)	Duration (minutes/day)	Allowable Unprotected Sound Level (dBA)	Duration (seconds/day)

Similarly, for humans most of the dose metrics address the damaging noise during 8-h workday, or for residential evaluations, a 24-h day (Table 1).

Table 1. — Noise Level Exposure Standard based on duration per day for unprotected hearing (source: American Conference of Governmental Industrial Hygienists Threshold Limit Values for Noise Exposure). Employers must implement protection for workers, who in an 8-hour period, would exceed a time-weighted average of 85 dBA (https://lni.wa.gov/safety-health/safety-rules/chapter-pdfs/WAC296-817.pdf).

80	24	97	30	115	28.12
82	16	100	15	118	14.06
85	8	103	7.5	121	7.03
88	4	106	3.75	124	3.52
91	2	109	1.88	127	1.76
94	1	112	0.94		

The military also uses dose. In areas where the 8-h time-weighted noise average equals or exceeds 85 dBA[6] (i.e.,"*hazardous noise area*") military and civilian personnel working in such areas are put in the Navy's Hearing Conservation Program and are identified as "at risk." Those assigned to that program are required to wear effective hearing protection and undergo routine health monitoring.

Paul Schomer extrapolated dose from one recorded, low-level carrier landing practice session involving four EA-18G Navy jets flying iterative loops over four discrete recording sites (*positions*) in Coupeville, Washington. His workup in Table 2 reveals that over a

---

[6] OPNAV M-5100.23. https://www.med.navy.mil/Portals/62/Documents/NMFA/NMCPHC/root/Occupational%20and%20Environmental%20Medicine/Pages/OCCUPATIONAL%20AUDIOLOGY%20AND%20HEARING%20CONSERVATION%20DIVISION/REGULATIONS%20AND%20INSTRUCTIONS/8opnav-5100-23g-chap-18-only.pdf?ver=ZSwg5zMpv0LEQY9r20OyBQ%3D%3D

month's time anyone exposed to the average number of Navy overflights would experience 1.3 to 4.2 times the Navy's threshold for declaring a hazardous noise zone and require their inclusion in a health monitoring program.

The military and the civilian workplace also recognize noise dose protection needs during pregnancy, both for the well-being of the mother and fetus. Well-documented

Table 2. — Analysis of JGL 2013 data converted to 8-hour time weighted averages (TWA), showing time of exposure to noise levels 85 dBA to >115dBA at the four JGL outdoor by recording positions (stations) and how each exposure amount (or dose) relates to the Navy-defined hazardous noise zone (i.e., designation of a hearing conservation zone).

Total time over (s)	Cummulative time in seconds by position (1-4)				Navy full dose time exceeded		Actual percent of full Navy dose exposure by position			
	1	2	3	4	Seconds	Minutes	1	2	3	4
85 dBA	448	855	365	600	28,800	480	0.2	1.1	0.4	0.4
88 dBA	381	538	257	482	14,400	240	0.5	1.7	0.6	0.7
91 dBA	315	299	169	375	7200	120	0.8	2.0	1.0	1.5
94 dBA	254	152	97	267	3600	60	1.9	1.6	0.9	2.0
97 dBA	184	93	63	195	1800	30	3.1	2.4	1.3	3.3
100 dBA	128	50	39	135	900	15	5.6	2.4	2.0	6.6
103 dBA	78	28	21	76	450	7.5	9.1	3.6	3.3	8.9
106 dBA	37	12	6	36	225	3.75	7.1	3.1	1.3	10.2
109 dBA	21	5	3	13	112.5	1.875	11.6	4.4	1.8	10.7
112 dBA	8	0	1	1	56.25	0.9375	10.7	0.0	1.8	1.8
115 dBA	2	0	0	0	28.125	0.46875	7.1	0.0	0.0	0.0

Percent of Navy permitted daily noise exposure for one flying session	58	22	14	46
Percent of Navy permitted daily noise exposure for two sessions (×2)	115	45	29	92
Number of flyovers at each position recorded for the session/position	35	43	26	28
Percent of Navy permitted daily noise exposure dose per flyover	1.66	0.52	0.54	1.64
Percent of Navy permitted daily noise exposure dose for average of 255 overflights/month (i.e., 6120 operations/year = 3060 overflights/year/12 months = 255)	423	133	138	418

are both direct effects of noise on the fetus and indirect effects from the mother, primarily as related to stress hormones known to be heightened by noise. https://www.degruyter.com/document/doi/10.1515/reveh-2021-0166/html?lang=en

In a nationwide cohort study of 857,010 single births, which were adjusted for BMI, smoking, parity, education, physically strenuous work, and low job control, exposure to high (>85 dBA) levels of occupational noise throughout the pregnancy (full time workers) was associated with an increased risk of the child being born small for gestational age. A similar increase was seen for low birth weight for high levels of noise. The authors concluded, "*The study strengthens the evidence that pregnant women should not be long-term exposed to high levels >85 dBA of occupational noise during pregnancy. Intermediate exposure should be studied further.*"

https://www.sciencedirect.com/science/article/pii/S0048969718336572X

With regard to noise creating pregnancy complications, one study found "*Occupational noise exposure could increase the risk of preeclampsia [i.e., serious health problems for the mother and infant], according to the findings*."
https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1026996/full

A study of over 1.4 million children born between 1986 and 2008 showed increased risk of hearing dysfunction for those whose mothers were exposed to workplace noise levels ≥85 dB. [https://www.hear-it.org/noise-exposure-harms-hearing-fetus]

Given the above, we suggest the FAA recognize 85 dBA as the base for acoustic, non-acoustic, and fetal damage and adopt an accumulative 24-hour time-weighted average of <85 dBA as the safe (or low risk) noise exposure threshold. Because there are a number of non-acoustic health issues linked to noise pollution, issue-by-issue thresholds may become warranted as research reveals greater understanding. Until such time as more

definitive or more informed dose thresholds are identified, 85 dBA seems to be reasonable and warranted given our knowledge today.

6. Communication.

6.a. Please identify whether and how the FAA can improve communication regarding changes in noise exposure (e.g., what information FAA communicates, where and with whom FAA communicates, what information methods FAA uses to communicate and the venues at which FAA shares this information). Please explain your reasoning.

6.b. Should the FAA consider revisions to its policy on the use of supplemental noise metrics in the FAA's NEPA procedures? Please explain how this policy should be modified to improve FAA communication of noise changes when the FAA is making decisions that affect noise. Please explain your reasoning.

The FAA has written in its consideration of policy change:

> A downward adjustment to the definition of adverse noise exposure will not change the actual noise environment. Nor will real-world noise experienced by individuals and communities be changed if the FAA changes its criteria for identifying significant new noise exposure associated with proposed actions being examined in a review pursuant to the National Environmental Policy Act of 1969 (NEPA) or the thresholds for determining land use compatibility. No policy change on its own will reduce the levels of aviation noise on the ground. Only the adoption of quieter technology, a reduction in aircraft operations, voluntary changes to the way aircraft operate to and from an airport through the use of

informal noise abatement procedures that Air Traffic Control can utilize when feasible or appropriate, or a combination of these measures could reduce the amount of noise experienced by communities.

Yes, policy is not like an enforceable law, but policy does inform the public, which in turn can create political pressures that incentivize reductions of noise exposure, motivate industry to develop quieter technologies, and procure ways to reduce operations or alter their geographic distribution, all of which the FAA notes above would lessen exposure and improve future outcomes. As such, policy becomes a catalyst for action.

6.c. What information about the change in noise resulting from civil aviation operations (e.g., UAS or drones, helicopters, fixed wing aircraft, rockets/commercial space transportation vehicles, and new entrant technologies) should the noise metric communicate to the public? Please explain your reasoning.

6.d. Please explain how the public will benefit if the FAA implements your proposal in response to Questions 6.a and 6.b.

Use of noise dose for assessing acoustic and non-acoustic health risks, along with DNL to index

annoyance, would be a major step forward into the 21st Century and be more in tune with its awakening and informed population. In addition, the public would understand and accept dose more readily than DNL, and averaging AAD + ABD would vastly mitigate the controversy over whether AAD or ABD should be used in a given situation.

7. NEPA and Land Use Noise Thresholds Established Using DNL or for Another Cumulative Noise Metric. The FAA has several noise thresholds that are informed by a dose-response curve (Schultz Curve [29]), which historically provided a useful method for representing the community response to aircraft noise. Two of the noise thresholds informed by the Schultz Curve are the FAA's significant noise impact threshold for actions being reviewed under the National Environmental Policy Act and the land use compatibility standards established in 14 CFR part 150, Appendix A. Both of these rely on the cumulative noise metric DNL and are referred to collectively in this question and questions 8–10 as "the FAA noise thresholds." On January 11, 2021, the FAA published the results of the Neighborhood Environmental Survey, [30] a nationally representative dataset on community annoyance in response to aircraft noise. The Neighborhood Environmental Survey results show higher percentage of people who self-identify as "highly annoyed" by aircraft noise across all DNL levels studied in comparison to the Schultz Curve.

a. How should the FAA consider this information (i.e., the Schultz Curve and Neighborhood Environmental Survey findings) when deciding whether to retain or modify the FAA noise thresholds [(31)] established using the DNL metric or to establish new FAA noise thresholds using other cumulative noise metrics? Please explain your reasoning.

NEPA requires agencies to apply the *best available science* (BAS), which generally means the most current, authenticated and validated science. The outdated and discredited Schultz curve and revised Schultz curve cannot meet the BAS requisite, whereas the results of the Neighborhood Environmental Survey (NES) do. Hence the NES needs to be adapted into FAA policy. Doing so will put the U.S. in sync with the direction being taken by the rest of the world.

Such a change in policy may be perceived as a logistical problem because it would increase the populations within the new and larger high annoyance contours. But really there is no choice here; BAS trumps an agency's comfortable history and understandable inertia.

The resultant increase in size of the annoyed population does have an attendant consideration that could reduce that population. The significance level for high annoyance was set at about 14% of the affected population. That numeric definition of significance could be increased since it is apparently arbitrary. Whether that could be justified would be up to FAA.

7.b. Should the FAA consider other or additional information when deciding whether to retain or modify the FAA noise thresholds that were established using the DNL metric or to establish new FAA noise thresholds using other cumulative noise metrics? Please describe the reason for the recommendation and identify the data, information, or evidence that supports the recommendation.

The DNL scale means little to average the citizen who cannot relate it to everyday experiences with noise, like a rock concert, fire siren, or chain saw. In the 1960s “annoyance” may have been considered as a reasonable indicator of noise impact. Now, 60 years later, science has revealed serious health effects related to noise. Hence, to continue to focus on “annoyance” would miss the elephant in the room — body ”damage.” The impacts of noise on health must trump indexing irritation.

While annoyance links to stress, and hence has a causal relation to health, we are unaware of a scale linking annoyance levels to stress levels. Furthermore, given the variables inherent in DNL, it is a weak predictor of health outcomes. For example, as noted above by Paul Schomer, a 65 DNL for a year is 91 dB if it comes in one day, but 140 dB in 1 second, and 170 dB in 1 ms. Hearing loss risk under those four 65-DNL scenarios would range from slight to highly likely to certain. So, while DNL may be okay indexing annoyance, dose would be far better for assessing health damage risks.

7.c. How should research findings on auditory or non-auditory effects (e.g., speech interference, sleep disturbance, cardiovascular health effects) of noise exposure caused by civil aircraft and vehicles be considered by the FAA when it decides whether to retain or modify the FAA noise thresholds [(32)] that were established using the DNL metric? How should the FAA consider this same research when deciding whether to establish new FAA noise thresholds using other cumulative noise metrics? Please explain your response.

Noise produces three discrete effects: 1) hearing loss, 2) health risk, and 3) reduced livability (diminution of quality of life). One index, DNL, is not well suited to identify risks for all three. While DNL (corrected to better accommodate AAD and ABD) may be an acceptable

index for livability, acoustic health needs its own index, as does non-acoustic health, both of which call for dose-based indices. As required by NEPA, the best available science should be used in establishing those dose-based thresholds (see response to 5.a).

7.d. In examining whether to change its metrics and thresholds for noise, the FAA needs reliable information to support any changes. One type of information that the FAA can rely on is epidemiological evidence. This means the study (scientific, systematic, and data-driven) of the distribution (frequency, pattern) and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, global). What amount of epidemiological evidence is sufficient to provide the FAA with a sound basis for establishing or modifying the FAA noise thresholds [(33)] either using the DNL metric or another cumulative noise metric? Please explain your response.

The question asked here is, "*What amount of epidemiological evidence is sufficient to provide the FAA with a sound basis for establishing or modifying the FAA noise thresholds either using the DNL metric or another cumulative noise metric?*" How much evidence is needed is in the eye of the beholder, and it surely is not quantifiable. There is no black-white evidence tipping point.

Science and scientists, however, through research have a way of gradually building a consensus around a scientific question, which generally precedes and leads to public recognition and acceptance. The risks and impacts of cigarette smoking are a perfect example. As referenced in our response to question 5.b, it seems we are now at that point of transitioning from scientific coalescence around a noise/health cause-and-effect to public recognition and acceptance, as exemplified by this June 2023 piece in the NY Times: NY Times on Noise Impacts.

While there remains much to learn about the impacts of noise on acoustic and non-acoustic health, the weighty epidemiological evidence has surpassed a "sound basis" for adopting more informed policies and thresholds.

7.e. Should the FAA consider using factors other than annoyance to establish FAA noise thresholds [(34)] using the DNL metric or other cumulative noise metrics? What revisions to existing FAA noise thresholds or new noise thresholds do you recommend be established and why? Please explain your response.

One metric is not best to fit all. For example, DNLs are far weaker than noise dose for assessing hearing damage. Annual average wind speed might be useful in considering windiness in one area versus another, but it would probably mask comprehension of damages done from hurricanes.

As discussed in 5.b, dose uncomplicated by time of non-damaging noise would better serve policy on how to best protect citizens. As research expands understanding of noise impacts on various aspects of health, different thresholds will likely be discovered. FAA policy could and should reflect the lowest dose threshold accepted at that time, realizing of course, that any known and unidentified higher thresholds would be accommodated by the lowest or most conservative.

8. FAA Noise Thresholds Using Single-Event or Operational Metrics. As the FAA learned from the results of the NES, people are bothered by individual aircraft noise events, but their sense of annoyance increases with the number of those noise events. Should the FAA consider employing new FAA noise thresholds [(35)] using single-event or operational metrics? If the answer is "yes," which metrics should be used to establish the FAA noise thresholds? What should be the relevant noise exposure level for the new noise

thresholds you propose? Please explain your reasoning. If the answer is "no," please explain your reasoning.

Yes. As noted iteratively in the above, dose combines loudness and frequency of noise events without the confounding influence of non-damaging noise time. As noted in 7.e, the dose threshold should be the lowest value that science has identified to date. At present, that accepted threshold seems to be a time-weighted average of 85 dB over 8 hours, as discussed in 5.b. The 8-hour period should be readily extrapolated to 24 hours.

Based on that dose threshold and as shown by Schomer in Table 2 in 5.b, percent of the dose threshold could provide a strong yard stick for examining the severity of noise exposure.

9. FAA Noise Thresholds for Low-Frequency Events. Should FAA establish noise thresholds [(36)] for low-frequency events, such as those associated with the launch and reentry of commercial space transportation vehicles authorized by the FAA Office of Commercial Space Transportation? If the answer is "yes," which metrics should be used to establish the noise thresholds? What should be the relevant noise exposure level for the new noise thresholds you propose?

Please explain your reasoning. If the answer is "no," please explain your reasoning.

Yes. LFN is recognized as a factor that has been linked to non-acoustic health issues, presumably due to its matter penetration power, in this case the animal body. While more research may be needed prior to establishing a threshold, it certainly should be a priority for policy consideration. The Growler jet we are exposed to is named for its LFN profile; many folks report far worse reactions to its noise compared with its predecessor (the Prowler), even though the A-weighted decibel levels of the two aircraft are fairly similar.

The use of A-weighting noise measurement was selected because it matches the perception of loudness by the human ear. Jet engines, both commercial and military, have a large sound content of lower frequencies. These low frequencies impact the body in ways beyond the ear and sound perception. A-weighting removes noise below 1 kHz, thereby missing much of the impacts on people and animals. It would be appropriate to either change to C-weighting, or set limits for both A-weighting and C-weighting.

10. Miscellaneous. What other issues or topics should the FAA consider in this review regarding noise metrics, the method of calculating them, the establishment of noise thresholds, [37] or FAA's method of communicating the change in noise exposure? Please explain your response.

Another commenter suggested the FAA use "number above per period" (NAPP). That is basically the binary approach (okay/not okay) the USFWS employs in assessing noise disturbance to listed marbled murrelets (i.e., the number of exposures to noise ≥92 dBA in a year's time; see 5.b response). Our suggestion to use dose is quite similar in that it quantifies exposure over a period 8 or 24 hours (or whatever), but in addition it adds weight to the results as loudness increases (see Table 2 in 5.b). Under the reasonable assumption that health risks go up directly with increasing noise levels, the dose metric would seem to be more informative than NAPP.

The public may never fully grasp or appreciate a DNL or dose threshold. A partitioned scale could be more informative and better accepted. That in mind, the FAA might want to consider supplementing dose and DNL thresholds with a simple "Noise Livability Index," perhaps something like the example chart below.

Qualifying Metrics	Noise Livability Index	Grade
DNL < 55 -and- Dose: <33% of Threshold	Good	**A/B**
DNL = 55 to 64 -and- Dose: 33% to 66 % of 85 DNL Threshold	Acceptable	**C**
DNL = 65 to 84 -and- Dose: 66% to 99% of 85 DNL Threshold	Poor	**D**
DNL ≥85 -and- Dose ≥100% of 85 DNL Threshold	Unfit for Habitation	**E**

11. Literature Review. In this review, the FAA will examine the body of scientific and economic literature to understand how aviation noise correlates with annoyance as well as environmental, economic, and health impacts. The FAA also will evaluate whether any of these impacts are statistically significant and the metrics that may be best suited to disclose these impacts. A bibliography of this body of research is available for review in the Background Materials tab in the Docket and as Appendix 1 to the FAA framing paper entitled, The

Foundational Elements of the Federal Aviation Administration Civil Aircraft Noise Policy: The Noise Measurement System, its Component Noise Metrics, and Noise Thresholds. This framing paper is available at: https://www.faa.gov/noisepolicyreview/NPR-framing. Please identify any studies or data regarding civil aviation noise not already identified by the FAA in the bibliography that you believe the FAA should evaluate. Please explain the relevance and significance of the study or evidence and how it should inform FAA decisions regarding the policy.

The formal literature is rife with research publications and meta-analyses revealing the effects of noise, moderate to extreme, on individuals and communities. Surely the FAA has most of them. The citizens of Whidbey Island, Washington, thank the FAA for facilitating this important survey.