

Public Health Review

**U.S. Air Force F-35A Operational Basing  
Environmental Impact Statement**

December 17, 2012

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#### **I. INTRODUCTION**

The Vermont Department of Health was asked by concerned citizens to evaluate the potential health effects resulting from the basing of F-35 jets at the Burlington Air Guard Station. This report addresses the issue, but does not make a recommendation for or against allowing the F-35 jets.

The decision regarding whether or not to approve the F-35 jets is a federal responsibility. Permitting decisions are made by the Air Force, based on the findings of their Environmental Assessments and Environmental Impact Statements (EISs), conducted under the requirements of the Environmental Protection Agency's (EPA) National Environmental Policy Act (NEPA).

The response that follows is based on the Health Department's review of the Air Force's EIS and relevant health effects literature. While Health Department experts read and analyzed the EIS and limited pertinent literature, resource limitations make it prohibitive for us to undertake a process equal in rigor to the EIS. This report is also not intended to serve as a complete Health Impact Assessment. If such an assessment is warranted by the Air Force, our experts could serve on the HIA team and connect with the medical and research communities as needed. The Health Department is responsible for tracking health trends over time and across populations and, therefore, could establish a method to collect and share health data for future surveillance.

As with any decision of this magnitude requiring an EIS study, there are potential adverse health effects, which is what this report addresses. The Health Department review is one step in a comprehensive process. The closing recommendations speak to that fact. More information is needed in specified areas to more accurately evaluate potential health risks, and strategies that can mitigate potential health impacts should be identified and assessed.

A major limitation of this analysis is that most of the research available focuses on general environmental noise, which may or may not include airports. Only a subset of the literature reviewed focused on airport or aircraft noise. Of these, only two considered the impacts of military aircraft. It is therefore difficult to know whether the health outcomes resulting from exposure to noise from F-35s would be comparable.

The EIS estimates that the peak noise level of the F-35 will be 115dB, although the sound levels actually experienced by the public will vary depending on the distance from the aircraft, time, weather and airfield acoustics. There are many sources of noise in the everyday environment that have sound levels similar to or greater than the F-35. Examples of these noise sources include snowmobiles (100 dB), snow-blowers (105 dB), car horns (110 dB), leaf blowers (110 dB), rock concerts (110 dB), headphones (112 dB), football stadiums (120 dB) and sirens (130 dB). Despite this, the noise generated by the F-35s continues to be a source of concern for local communities. These concerns are exacerbated by 1) unanswered questions and inconsistencies in the EIS, 2) models,

terms and concepts used in the EIS that are difficult to understand, and 3) new information that continues to emerge about F-35s.

The following is a summary of environmental exposures and their potential health effects.

## II. NOISE

### Acute Exposure Effects

- **Hearing Loss:** On take-off, the F-35 is estimated to have a maximum sound level of 115 dB at 1,000 feet above ground level. This is 21 decibels louder than the maximum sound level estimated for the F-16 (Executive Summary, Table 6-7). The Air Force EIS (Volume II, C-27, p. 181) cites the results of Ising *et al.* (1999), which “indicate that repeated exposure to military low-altitude flight noise with  $L_{max}$  greater than 114 dB, especially if the noise level increases rapidly, may have the potential to cause noise induced hearing loss in humans.” The occupational noise exposure regulation for continuous sound exposure is 115 dB for 15 minutes or less (OSHA 29 CFR 1910.95). National Institute for Occupational Safety and Health and the American Speech Language Hearing Association recommend a more conservative permissible exposure level of 115 dB to not exceed 28 seconds per day. More information from the Air Force is required to determine whether members of the public living or working in the proximity of the airport will be exposed to F-35 aircraft noise at these levels.

### Chronic Exposure Effects

- **Hearing Loss:** While some studies have found evidence for a reduction in hearing ability in individuals exposed to high levels of airport noise (Chen and Chen, 1993), others have not (Fisch 1977, Andrus et al. 1975, Wu et al. 1995). A 2000 literature review by Passchier-Vermeer & Passchier found that there was evidence for a relationship between environmental (not specifically aircraft) noise and hearing impairment with levels above 70dB (averaged over a 24-hour period). As stated in the EIS, the EPA has established a 24-hour exposure of 70 dB to protect 96 percent of the population from a permanent threshold shift greater than 5 dB (USEPA 1978). It is worth noting that someone living in a 70 day-night sound level is unlikely to have a 24-hour exposure of 70 dB due to the 10dB “penalty” added to nighttime noise, and due to the noise reduction afforded by their home. The number of people who would be exposed to levels that pose a risk of hearing loss will depend in part on the accuracy assessment of baseline conditions. Using the noise modeling software NOISEMAP, the Air Force estimated that currently 371 acres of defined residential land fall within the 65-85dB day-night sounds level (executive summary). Using the Integrated Noise Model software, Burlington International Airport has previously estimated that 103 acres of defined residential land fall within the 65-85dB day-night sound level (Volume I,

BR4-62, p218). The Air Force should provide an explanation for the discrepancy between two models.

- **Cardiovascular Health Effects:** According to two meta-analyses, there is evidence of a relationship between environmental noise exposure and cardiovascular disease (specifically hypertension and ischemic heart disease). Passchier-Vermeer & Passchier (2000) provide an observational threshold of 70 db day-night sound level for these effects, while Babisch and van Kamp (2009) do not, due to the lack of methodological consistency among the studies reviewed. When effects are found, they are not consistently significant. For studies of cardiovascular disease, like any of the health outcomes discussed here, it is difficult to adequately control for the many factors that may be associated with both the level of exposure and the prevalence of the health outcome (eg, socio-economic status, demographic make-up, underlying health status, other environmental exposures).
- **Annoyance:** The EPA defines annoyance as any negative subjective reaction on the part of an individual or group (EPA 1974). A day-night sound level of 65 dB has been widely used as a criterion that is both protective and practically achievable (Federal Interagency Committee on Noise 1992 in Air Force 2012). A day-night sound level of 65 dB corresponds to 12 to 13 percent of the exposed population being highly annoyed.
- **Sleep Disturbance:** According to the literature, sleep disturbance can result in secondary health effects. The Air Force EIS states that “No flying between 10:00 pm and 7:00 am would be planned for the F-35As”, (Air Force EIS, Executive Summary, ES-9), so traditional nighttime sleeping hours are not expected to be disturbed. The World Health Organization identified 40 dB as the lowest observed level for adverse health effects for a 12 month period where the sound is measured outside the dwelling.
- **Speech Interference:** By itself, speech interference is not considered to be a health effect. However it is possible that persistent speech interference could affect linguistic and cognitive development in children. The EIS does not demonstrate a substantial increase in the frequency of speech interference events at representative locations, including schools.
- **Cognitive Development:** There is little evidence in the research literature that specifically addresses the effects of aircraft noise on cognitive development. Exposure to aircraft noise may influence factors that more directly relate to cognitive development (hearing ability, attentiveness, memory/recall, sleep disturbance). The EIS states that “because of the developmental status of young children, barriers to hearing can cause interferences or disruptions in developmental evolution” (EIS Volume II, C-31, p185). The EIS also states that, “although it is recognized that there are many factors that could contribute to learning deficits in school-aged children, there is increasing awareness that chronic exposure to high aircraft noise levels may

impair learning. This awareness has led the WHO and a North Atlantic Treaty Organization (NATO) working group to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites (WHO 2000, NATO 2000)” (EIS Volume II, C-31, p185).

### III. RISK OF SERIOUS MISHAPS OR CRASHES

The potential for crashes exist with any plane, and the F-35 is no exception. Based on historical data presented by the Air Force (Table BR3.4-1, EIS Volume 1, 4-47, p203), there is potential for a higher mishap rate with new aircraft at the beginning of their operational use. The EIS does not provide any information regarding observed crash rates of the F-35. The EIS does describes two Class A mishaps (\$2,000,000 total property damage or more and/or aircraft destroyed, fatality or permanent total disability) that have occurred to the Vermont Air National Guard, one in Williston, Vermont in 1965, and a second New Jersey in 1993.

### IV. FUEL DUMPING

This topic is not addressed in detail in the EIS. The EIS does state that “when circumstances require, fuel jettisoning is permitted above 10,000 feet above ground level, over unpopulated areas, and is generally overwater for applicable bases.” More information would be helpful to determine whether the practice of fuel dumping ever results in human exposures, and whether the possibility of human exposure will increase or decrease with F-35s as compared to current practices with F-16s. It would also be helpful to know if the fuel that is dumped is combusted as it is jettisoned, or whether it remains in liquid phase.

### V. AIR POLLUTION

The Vermont Department of Environmental Conservation, Air Pollution Control Division was asked to comment on the changes in air pollution emissions that would result from the F35s.

Based on estimates provided in the EIS (Volume I, p197-198), emissions of oxides of sulfur increase under both scenarios. Emissions of carbon monoxide, volatile organic compounds, and particulates decrease under both scenarios. The percent change from baseline for all criteria pollutants and carbon dioxide equivalents is given below:

	CO	NO <sub>x</sub>	VOCs	SO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	CO <sub>2e</sub>
Baseline emissions (tons)	153.8	48.42	19.11	8.37	8.55	7.8	18,225
Scenario 1 (% change)	-54%	-20%	-84%	127%	-81%	-80%	-17%
Scenario 2 (% change)	-42%	8%	-80%	205%	-75%	-73%	11%

The scale of these emissions under baseline conditions and under Scenarios 1 and 2 is comparable to other major industrial/point source facilities in Vermont. It would be helpful if details on the assumptions and emissions factors used were included in the Air Force’s EIS, as was done in the

The Air Force EIS for Burlington states that emissions factors from Mobile 6.2.03 were used to estimate emissions for mobile sources (EIS, Volume I, p195). The EPA has transitioned to the use of the Motor Vehicle Emissions Simulator (MOVES) as the standard model for on-road mobile source emissions modeling. MOVES emissions outputs typically show slightly lower volatile organic compounds, higher oxides of nitrogen, and higher particulate matter emissions than comparable Mobile 6 model runs.

## **VI. RECOMMENDATIONS**

During the remainder of the process, the Health Department recommends that the Air Force:

- Continue to work with the affected communities to understand and address their concerns about potential health impacts. Some of the areas that would benefit from additional information include the following: explanation of discrepancies between output from the "Part 150" and NOISEMAP noise models contours, greater detail on the frequency and timing of airfield operations, fuel dumping, and whether there are any new risks posed by the ordinance used with the F-35s.

Should the F-35s be based in Burlington, the Health Department recommends:

- Reduce noise and environmental impacts before the F35s are deployed, for example, through the use of engineering controls.
- Establish a sound level monitoring program for the F-35 to validate the modeled noise levels, confirm the affected populations have been correctly identified, inform mitigation efforts, and ensure that thresholds are not exceeded, as stated in the EIS (Volume I, 2-43, p93).
- Form a committee consisting of, but not limited to military personnel familiar with the literature and the health effects, sound experts, residents in the affected areas, air quality experts, and state and local officials. The goal of the committee would be to identify mitigation techniques to reduce potential environmental exposures. Techniques could include:
  - Identify consistent flight time windows so Vermonters are not alarmed, and can take precautions to eliminate their exposure.
  - Sound-proof schools and daycares.
  - Minimize the number of flights per year.
  - Vary flight paths to minimize the sound levels.