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EXPERT PANEL SAYS NOISE CONDITIONS NOT SATISFIED AT SEA-TAC

SEATTLE -- An independent panel of national experts on aircraft-related noise issues has concluded that the Port of Seattle's efforts to reduce noise impacts from Sea-Tac Airport are not sufficient to meet the conditions imposed by the Puget Sound Regional Council for authorization of the third runway.

The three-member panel's conclusion was a split decision, with two members finding that the Port has not sufficiently reduced noise impacts, and one member, Panel Chair Scott Lewis, finding that "the Port has met its burden."

The majority concluded, "Although the Port of Seattle has scheduled, pursued and achieved an impressive array of noise abatement and mitigation programs, the Port has not shown a reduction in real on-the-ground noise impacts sufficient to satisfy the noise reduction condition" imposed by the Regional Council.

In reaching their conclusions, panel members Scott Lewis, a Boston attorney, Dr. William Bowlby, a noise expert from Vanderbilt University, and Martha Langelan, an economist and consultant to the U.S. Department of Transportation and Civil Aeronautics Board, completed their involvement in a process initiated as a result of action nearly three years ago by the Regional Council.

The Council, as the region's growth and transportation planning agency under federal and state laws, decided in April 1993 that if certain conditions were met, the proposed third runway at Sea-Tac Airport was the best way to meet the region's long-term air transportation capacity needs.

At that time, the Council's General Assembly, composed of elected officials from throughout the region, approved by an 88 percent majority a resolution that endorsed a third runway at Sea-Tac, subject to the following conditions:

an independent evaluation of whether feasible demand management, system management and noise reduction efforts at Sea-Tac had been scheduled, pursued and achieved; and

a determination of whether a supplemental airport that could eliminate the need for the third runway could be sited within the region.

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The resolution established a deadline of April 1, 1996, for compliance with these conditions.

Following a consultant study that involved a look at numerous potential sites around the region, the Regional Council concluded in October 1994 that there was not a suitable site in the region for a supplemental airport.

State Secretary of Transportation Sid Morrison appointed the independent panel of national experts to monitor compliance with the noise and demand and system management conditions. In a series of meetings beginning in 1994, the panel received large volumes of written materials and lengthy testimony from the Port of Seattle, the Federal Aviation Administration, the Washington State Department of Transportation, the airlines, community groups including the airport Communities Coalition, Air Washington and Regional Commission on Airport Affairs, and other interested parties and individuals.

Ultimately, the Panel concluded that demand management steps such as improved efficiency at the airport, and system management options such as rail improvements, would not reduce demand for air travel through Sea-Tac enough to preclude the need for a third runway.

That left one final condition to be satisfied: whether the Port's noise reduction efforts have been sufficient.

The conclusions of the Panel will be reported to the Regional Council's Executive Board at its regularly scheduled meeting tomorrow (Thursday).

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STATE OF WASHINGTON
PUGET SOUND REGIONAL COUNCIL

In the Matter of:)
)
 Expert Arbitration Panel's Review of Noise and)
 Demand/System Management Issues at Sea-Tac)
 International Airport)
)

FINAL DECISION ON NOISE ISSUES

March 27, 1996

This is the Final Decision on Noise Issues by the Expert Arbitration Panel on Noise and Demand/System Management Issues (the "Panel"). After making a thorough and independent evaluation of all of the evidence and arguments that have been presented to us with respect to the reduction in noise impacts required by Resolution A-93-03 as a condition for the Puget Sound Regional Council's approval of a third runway at Sea-Tac International Airport, a majority of the Panel, consisting of Professor William Bowlby and Ms. Martha Langelan, has reached the following conclusion:

Although the Port of Seattle has scheduled, pursued, and achieved an impressive array of noise abatement and mitigation programs, the Port has not shown a reduction in real on-the-ground noise impacts sufficient to satisfy the noise reduction condition imposed by Resolution A-93-03.

Mr. Scott P. Lewis, Chair of the Panel, would find that the Port has satisfied the requirements of the Resolution, and dissents from this Decision.

We offer below a statement of the background and history of the Panel's consideration of Noise Issues under Puget Sound Regional Council ("PSRC") Resolution A-93-03, a summary of the basis of the majority's decision, recommendations about future efforts that could be taken to reduce the burden of aircraft-generated noise on the communities surrounding the Airport, a statement of the dissent, and some closing comments. In the majority's findings and conclusions, we have assessed the Port's compliance with the Noise Mediation Agreement (including the reliability of the Noise Validation Method), evaluated the effectiveness of the Port's noise abatement and mitigation efforts with respect to on-the-ground noise impacts, and addressed the nature of the "meaningful" and "reasonable" reductions in "real noise impacts" required by Resolution A-93-03.

BACKGROUND (BY THE PANEL)

The Panel was appointed in June 1994 by the Secretary of the Washington State Department of Transportation ("WSDOT"). The appointment of the Panel followed the adoption of Resolution A-93-03 by the Puget Sound Regional Council, the PSRC's promulgation of "Implementation Steps" for the Panel, and the execution of a Memorandum of Understanding ("MOU") among the PSRC, the Federal Aviation Administration ("FAA"), the Port of Seattle ("Port" or "POS") and the WSDOT.

The Resolution, which appears to us to be unique, provides that "the region should pursue vigorously a major supplemental airport and a third runway at Sea-Tac" and that the third runway "shall be authorized by April 1, 1996:

- a. Unless shown through an environmental assessment, which shall include financial and market feasibility studies, that a supplemental site is feasible and can eliminate the need for the third runway; and
- b. After demand management and system management programs are pursued and achieved, or determined to be infeasible, based on independent evaluation; and
- c. When noise reduction performance objectives are scheduled, pursued and achieved based on independent evaluation, and based on measurement of real noise impacts."

In October 1994, the Executive Board of the PSRC determined that within the meaning of the Resolution there was no "feasible" site for a major supplemental airport that could eliminate the need for the third runway. See Resolution EB-94-01. It was the Panel's responsibility to make "independent evaluations" to determine whether the demand/system management and noise conditions of the Resolution had been satisfied and, hence, whether the PSRC should authorize construction of the third runway.

After conducting several rounds of hearings on Demand/System Management Issues, the Panel concluded in December 1995 that within the narrow meaning of the Resolution, the demand and system management programs that had been presented to the Panel (including "high-speed" rail, congestion pricing and gate controls) were not "feasible" and, therefore, that this condition of the Resolution had been satisfied. We stress, however, that we did *not* find "high speed" rail (or interim improvements in existing rail service), congestion pricing or gate controls to be infeasible in the sense that they could not be realized or were unworthy of pursuit. In fact, based upon the extensive evidence that was offered to us, it is apparent to the Panel that a coherent, intermodal, cost-effective and environmentally sensitive regional plan for accommodating the rapidly growing need for transportation infrastructure in the Pacific Northwest would include interim improvements of the existing rail service in anticipation of the construction of a high speed rail system in the Portland-Seattle-Vancouver corridor, and the introduction of regulatory measures at the Airport designed to improve the efficiency of use of scarce airport capacity. The Panel's consideration of

Demand/System Management Issues is laid out in three separate orders: the February 24, 1995 Preliminary Order on Demand/System Management Issues; the July 27, 1995 Final Phase I Order on Demand/System Management Issues; and the December 8, 1995 Final Order on Phase II Demand/System Management Issues.

As a result of these two determinations, the only remaining condition for PSRC authorization of the third runway project has been the noise impact reduction condition established by the Resolution.

Throughout our consideration of Noise Issues, the Port, the Airport Communities Coalition ("ACC") and the Regional Commission on Airport Affairs ("RCAA") have participated actively. They offered the Panel volumes of evidence and distinguished expert testimony on the difficult questions posed by the Resolution. We received thousands of pages of noise measurements, analysis and interpretation, and many informative statements of position from the Port, the ACC and the RCAA, as well as from the FAA, the Airport Noise Group, the Port Patrol, Air Washington and many individual members of the public. The lead witnesses for the Port were Dianne Summerhays, from the Port's staff, and Paul Dunholter, a noise expert with Mestre Greve Associates. The Port has, from time to time, called upon other members of its staff and outside experts to support its position. The ACC has offered the expert testimony of Sanford Fidell of Bolt Beranek and Newman Systems and Technologies, and the RCAA has offered expert testimony by Alice Sutcr.

We held our first round of hearings on Noise Issues in August 1994, and on September 22, 1994 the Panel issued a "Procedural Order." We summarized the Resolution, the Implementation Steps and the MOU in the Procedural Order, and then acknowledged "that questions have been raised" about the scope of the Panel's inquiry on Noise Issues. As a result, we announced that we would consider Noise Issues in two phases. In Phase I, the Panel would address three distinct questions:

- Has the Panel been asked to determine whether the goals of the Noise Budget and the Nighttime Limitations Program, if achieved, would produce a significant reduction in real noise impacts on-the-ground?
- If so, would achievement of the noise reduction performance objectives of the Noise Budget and Nighttime Limitations Program produce a significant reduction in real noise impacts on-the-ground?
- Is the Noise Validation Methodology proposed by the Port a reliable method for determining, on the basis of measurements of actual on-the-ground noise using the existing noise monitoring system at Sea-Tac, whether the noise reduction performance objectives of the Noise Budget and Nighttime Limitations Program have been achieved?

If the Panel determined, in its Phase I decision, that the Noise Validation Methodology proposed by the Port is a reliable method for determining whether appropriate noise reduction performance objectives have been met, the Panel would turn in Phase II of its deliberations to the question of whether the Port had demonstrated that it had achieved the noise reduction required by the Resolution. We noted in the September 1994 Procedural Order that the Port has the burden of showing the Panel that it has satisfied the noise reduction performance objectives imposed by the

Resolution. Our Procedural Order was accompanied by extensive requests for information from the Port, the FAA and the public.

We returned to Seattle in December 1994 for two days of hearings, including an extended evening session near the Airport devoted to testimony from residents of the affected communities. We then issued our January 9, 1995 Order on Phase I Noise Issues. In our January 1995 Order, we summarized what we consider to be our responsibility under the Resolution with respect to the reduction in noise impacts that must be shown before the PSRC should approve construction of a third runway at the Airport. We held that to meet its burden under the Resolution, as we interpret it, "the Port must offer us reliable evidence, based upon actual measurements of on-the-ground noise, that by 1996 there has been an objectively measurable, meaningful reduction in aircraft noise impacts in the affected communities surrounding the Airport." As we said then, "the POS must establish that through whatever means, it has reduced the impact of on-the-ground noise in a way that residents of the affected communities could appreciate."

We noted, however, that because the Resolution contemplates that objective measurements of on-the-ground noise should be used, the Port would not be required to conduct surveys of residents in the affected communities to ascertain their subjective perceptions of Airport noise, even though such survey results could provide useful information to the Port, the public and this Panel. We recognized that the Resolution does not require the Port to reduce Airport noise to levels "acceptable" to the residents of the surrounding communities, but rather requires only that the Port achieve a significant reduction in the real noise impacts. We observed that "[b]usy jet airports, such as Sea-Tac, are inherently noisy, and it is unrealistic to expect that nearby communities would ever find the noise impacts generated by such airports to be 'acceptable.'"

Finally, both during the December 1994 hearings and in our January 1995 Noise Order, we cautioned the public that "the consequences — particularly the noise impacts — that might occur if a third runway were built at the Airport" were outside our jurisdiction. As we put it then, "this Panel cannot and will not undertake a review of the potential environmental consequences of building the third runway. Our responsibility, with respect to the Noise Issues, is limited to determining whether the POS has scheduled, pursued and achieved a meaningful reduction in real noise impacts at the *existing* Airport."

In anticipation of later hearings, in our January 1995 Noise Order we determined (a) that a showing that the Port had performed its obligations under the Noise Mediation Agreement was necessary, but not sufficient, to show compliance with the Resolution; (b) that the Noise Validation Method then proposed by the Port was not a valid method of establishing the required reduction in noise impacts, and (c) that 1993 should be used as the "base year" for purposes of the measuring whether the reduction in noise impacts required by the Resolution has been achieved (because nothing in the Resolution spoke to reductions in noise impacts that had already been achieved), but that the significance of the 1993-1996 data would "be best understood in the context of as much earlier data as the Port can make available to us."

We said that we would address three sets of subsidiary questions before resolving whether the Port had met its burden: "(a) what measures of noise impacts should be used (that is, what noise 'metrics' should be selected), (b) where should the measurements of noise be made, and (c) how much reduction in noise, by these measures, must be achieved, and over what time period?" We recognized that of these, the articulation of the required reduction in noise impacts presents "the

most difficult question." We did not presuppose that we could provide a satisfactory answer to this question without the benefit of input from the Port and the community. So, in our January 1995 Noise Order, we asked the Port to "show us (i) that it has articulated an appropriate standard for judging whether the reduction in noise impacts is sufficient, and (ii) that by that standard, the Port has achieved the required reduction."

Our January 1995 Noise Order led to a useful discussion of noise metrics that could be used to supplement the information provided by DNL and precipitated the collection of on-the-ground noise measurements by the Port at six supplemental monitoring sites, farther out from the Airport, that better represented significant portions of the affected population. In addition, the ACC subsequently submitted new information. Taking up the Panel's suggestion about the potential usefulness of survey data, the ACC commissioned Dr. Fidell to conduct a social survey to determine whether residents of the affected communities had perceived an improvement in their noise environment. Dr. Fidell conducted a telephone survey of over 1,400 residents in six neighborhoods affected by Sea-Tac-related noise.

When we reconvened in May 1995, the Port did not provide us, as we had asked that it should, with any workable standard that we could use to assess whether the reduction in noise impacts is adequate to demonstrate compliance with the Resolution. We were, as a result, unable to complete "Phase I" of the hearings on Noise Issues with a clear understanding of how the Port or the community advocates thought we should interpret the voluminous measurements of "on-the-ground" noise or the information about noise mitigation efforts that we had asked the Port to provide to us. To accommodate the Port's schedule, we called for a preliminary round of hearings on "Phase II" Noise Issues in November 1995 that was focused upon the question of what standard the Panel should use to make its decision and how the accumulating information about noise levels and mitigation efforts should be interpreted for purposes of resolving whether the Port had satisfied its burden under the Resolution. Following those hearings, we issued, on December 18, 1995, our Preliminary Order on Phase II Noise Issues.

We noted in our December 1995 Noise Order that these hearings had led to a resolution of the first two questions we had posed for Phase II: There was no significant dispute about what noise measures should be compiled or where the measurements of noise should be made. The most difficult, third question, however, remained controversial: "How much reduction in noise, by these measures, must be achieved, and over what time period?" The Panel was unwilling to accept the standard proposed by the Port or the standard proposed by the ACC. We noted that the selection of either of those competing standards for judging compliance with the Resolution would itself determine the outcome of these proceedings.

We felt strongly that it would be premature to decide then whether the Port had met its obligation under the Resolution and said that we would not make that determination until we had reviewed all the data to be offered to us early this year on reductions in noise impacts from 1993 through 1995 and on reductions in noise impacts following the 1990 Noise Mediation Agreement and leading up to the enactment of the Resolution in 1993.

In anticipation of a final round of hearings in February 1996, we provided some guidelines for what the Port should show in its "Compliance Report." We acknowledged that, as both the Port and the ACC had recognized during the course of the hearings, ultimately the Panel would have to rely upon our "best professional judgment ... to determine whether, taken as a whole, the pattern

of change in noise impacts is sufficient, in our judgment, to meet the requirements of the Resolution." We realized that the PSRC General Assembly, in adopting Resolution A-93-03, was seeking an impartial, objective assessment of a complex technical question. We said that, while we have always understood that our decision would have a "social or political character," we have felt strongly that "our exercise of judgment should reflect the best insights we can gain from established scientific sources about the significance of changes in various noise metrics as indicators of changes in the impact of noise on the people in the communities surrounding the Airport."

We asked the Port, and the community advocates, to address the following essential issues in written Position Statements:

- What reductions in on-the-ground noise impacts are shown by the various measurements and evidence compiled by the Port?
- How should the Panel interpret the significance of the reductions in noise impacts shown by the Port?
- Why should the Panel find that the noise reduction condition established by the PSRC's Resolution has been satisfied?

The Port responded to our December 1995 Noise Order by compiling and distributing a vast array of noise measurements and related information about its noise abatement and noise mitigation efforts. In its Position Statement, which was supported by the expert testimony of Paul Dunholter, the Port argued that the Panel should find that it had satisfied the requirements of the Resolution because, based upon the measurements of noise and modeling assumptions used by the Port, thousands of people no longer live in areas judged by the FAA to be incompatible with residential use; thousands of people are no longer "highly annoyed" by aircraft noise; high and medium speech interference has been reduced; the potential for awakenings resulting from loud aircraft events has been reduced; and thousands of homes have been relocated or insulated. In fact, the Port urged the Panel to conclude that its standard had been met "without a detailed review of the data" because noise "must have been" reduced because noisy planes have been greatly reduced overall and virtually eliminated at night; because the insulation of homes and schools has been "aggressively pursued and achieved;" and because people outside the Port have said that its noise programs have been successful.

The ACC submitted an opposing Position Statement, based upon the expert testimony of Dr. Fidell, that made three principal assertions: (i) that the estimates of population benefits used by the Port were not reliable because the tools used to derive them were not sufficiently precise to accurately predict benefits from small changes in noise levels; (ii) that, in any event, the reductions in noise relied upon by the Port were not "significant" in the sense that they could be appreciated as reductions in noise impacts for the affected populations; and (iii) that the Port could have scheduled, pursued and achieved a "meaningful" reduction in noise impacts if it had not rested upon the Noise Mediation Agreement. The RCAA also submitted an opposing Position Statement, and many members of the public wrote to the Panel to express their view that the Port had not reduced the impact of airport noise on their communities. Air Washington submitted a statement in support of the Port.

FINDINGS AND CONCLUSIONS (BY THE MAJORITY)

Because this has been a lengthy and complex proceeding, we believe it may be useful to set forth our reasoning and the technical bases for our conclusions. Our findings and conclusions follow the general structural framework of the Port's argument.

In brief, the Port contends (a) that the overall noise level at the Airport has shown a consistent downward trend since 1989/1990, and has continued to decline (albeit at a lesser rate) since 1993; (b) that it has complied with the 1990 Noise Mediation Agreement with respect to both noise abatement and noise mitigation programs; (c) that the appropriate base year for comparative purposes should be 1989/1990 (or, alternatively, 1992), rather than 1993, the year Resolution A-93-03 was adopted; (d) that by a variety of noise metrics, the Port has shown reductions in the actual, measured, on-the-ground A-weighted sound levels produced by the Airport since 1989/1990, 1992 and 1993; (e) that those reductions translate, through a modeling and estimation process, into reductions in speech interference, sleep disruption, number of people "highly annoyed" by airport noise, and other "real noise impacts" on the ground; and (f) that the change in "noise impacts" can be translated, in turn, into reliable estimates of thousands of people who have received non-trivial benefits from the noise reductions. Proceeding from that logic, the Port proposed the following standard for our decision:

Compliance with Resolution A-93-03 will be found if the entire record of reductions, taken as a whole, shows a pattern of reductions for several thousand people, counting for each measure only people for whom the reduction is neither inappreciable nor meaningless. The determination will focus on the reduction in noise impacts from 1993, but will not ignore improvements achieved before Resolution A-93-03 was enacted.

At the Panel's request, the Port measured changes in noise with two metrics in addition to DNL (Day/Night Average Sound Level), an overall measure of daily A-weighted sound levels, which weights nighttime noise more heavily than daytime noise and is commonly used in the industry to assess the total level of airport noise. They are SEL (Sound Exposure Level), a standard measure of the level and duration of single noise events, e.g., an aircraft flyover, and TA (Time Above), a standard measure of the total time in seconds, minutes, or hours that aircraft noise exceeds a 65, 75, or 85 dB level in a 24-hour period. Together with changes in the number and distribution of aircraft operations, these metrics provide a more complete picture of changes in the airport noise environment than is given by DNL alone. The Port also reported the progress of its noise mitigation (building insulation) programs.

The Port has presented its noise data and conducted its analysis on the basis of the actual number of operations at Sca-Tac Airport and the specific fleet mix of aircraft serving the Airport during the relevant time period. Air carriers account for almost 60 percent of operations at the Airport (e.g., 54.0 percent in 1989/1990, and 58.5 percent in 1995), while commuter airlines represent about 40 percent (42.6 percent in 1989/1990, and 38.7 percent in 1995). Air carrier operations have

been increasing, and total operations at Sea-Tac Airport have fluctuated over the past eight years as follows:

TOTAL AIRCRAFT OPERATIONS, SEA-TAC AIRPORT, CY 1988-1995 (IN THOUSANDS)

CALENDAR YEAR	1988	1989	89/90*	1990	1991	1992	1993	1994	1995
TOTAL OPERATIONS	316	335	354	355	339	346	339	353	387
AIR CARRIER OPERATIONS	177	182	191	193	187	196	200	212	226

* Operations for combined 1989/1990 base "year," per Port Compliance Report.

Source: Sea-Tac International Airport, Traffic and Operations Report.

In some cases, the Panel's request for time-series data on the various noise metrics required the Port to back-calculate certain airport data. For example, the Port calculated DNL values for earlier periods using the fleet mix at the time and the aircraft SEL data measured in 1995 at the 11 permanent Remote Monitoring Station ("RMS") sites and the six supplemental monitoring sites.

The Panel's task under Resolution A-93-03 is to evaluate the results of, first, the Port's noise abatement efforts (the impact of reductions in aircraft noise), and second, the Port's noise mitigation programs (the impact of building insulation). The Resolution itself speaks to overall reduction of "real noise impacts," and the Port has presented a substantial body of information on its efforts with respect to both noise abatement and mitigation. Accordingly, we have taken both aspects of noise control -- abatement and mitigation -- into account in our assessment of the reduction of noise impacts.

We address the threshold points first, including the direction of change in noise levels since 1993, the Port's compliance with the Noise Mediation Agreement, and the issue of the base year; turn next to our evaluation of the results of the Port's actions with respect to (i) noise abatement and (ii) noise mitigation; discuss the concept of "meaningful" and "reasonable" reductions in noise; then summarize our findings with respect to the overall reduction in noise impacts the Port has "scheduled, pursued, and achieved."

I. OVERALL DIRECTION OF CHANGE

As a result of the abatement and mitigation programs instituted by the Port under the 1990 Noise Mediation Agreement, the general direction of aircraft noise levels (measured objectively by noise monitors) has been downward since the PSRC General Assembly enacted Resolution A-93-03 in April 1993. The amount of change may be small, but it is not zero. When we rendered our January 1995 Noise Order, however, the Panel determined that the Port had the burden of showing that the reductions in noise impacts were "significant" or "meaningful;" we held that some reductions, while desirable and beneficial, might be too small to be sufficient to satisfy the Resolution. Accordingly, we find that the noise reduction condition of Resolution A-93-03 is not satisfied by the mere existence of a slight downward trend in DNL and SEL since 1993.

II. COMPLIANCE WITH THE NOISE MEDIATION AGREEMENT

Throughout this proceeding, the Port has relied on the 1990 Noise Mediation Agreement ("NMA" or "Agreement") as the cornerstone of its noise abatement and mitigation programs. The Agreement was the culmination of a long public process and includes many important components (principally the Noise Budget, the Nighttime Limitations Program and the Noise Remedy Program). It was, in 1990, an important milestone in the use of Stage 2 aircraft restrictions to reduce the adverse environmental impacts of airport operations. The Port was aware, however, that substantial numbers of residents were unsatisfied with the noise mediation process and the results it produced; many were extremely upset when, hard on the heels of the Agreement, the FAA's adoption of the Four Post Plan also introduced a major realignment of flight tracks (and resulting noise impacts). In addition, there has been vigorous opposition to the prospect of a third runway in the face of promises that many citizens apparently believe were made when the second runway was built. In light of that ongoing history of vocal opposition and concern about airport noise, the enactment of Resolution A-93-03 in April 1993 should have served notice to the Port that it would not only be held accountable for meeting its programmatic obligations under the Noise Mediation Agreement, but would also have to show that its noise programs were, in fact, producing results in the form of meaningful, measurable, on-the-ground reductions in noise impacts. Pursuant to the Resolution, the Panel's January 1995 Noise Order stated that compliance with the Port's obligations under the Agreement was a necessary, but not sufficient, element of satisfying Resolution A-93-03.

We have reviewed the Noise Mediation Agreement in detail, to ascertain whether the Port is currently satisfying the noise abatement and mitigation commitments it made under the Noise Budget, the Nighttime Limitations Program, the Noise Remedy Program, and the other elements of the Agreement.

With respect to the Noise Budget, given a measured reduction in DNL of 3.4 dB at the eleven permanent monitoring sites as of the end of 1995, we can be confident that the goals of the Budget have thus far been met. The 3.4 dB reduction realized by 1995 is already 1.8 dB better than the stated goal for 1996 and is only 1.0 dB under the goal for 2001. According to the Port, the complexity of the Noise Budget calculations apparently also encouraged certain airlines to opt for the simpler phased Stage 3 conversion option, which we believe to be a plus.

In connection with the Noise Budget, the PSRC Executive Board's Implementation Steps also requested the Panel to review the validity of the Port's Noise Validation Method ("NVM"), which is used to translate measured DNL into the ANEL metric used in the Noise Budget. We find that the NVM is a sufficiently reliable method for purposes of determining, on the basis of measurements of actual on-the-ground noise, whether the Port has met the *current* noise reduction objectives (expressed in the ANEL metric) of the Noise Budget, but we reach that finding only because the 1995/1996 goal for reduction in ANEL has been exceeded by more than a decibel. We are not convinced that the ANEL goal for the year 2001 will be achieved, because of the growth in the number of aircraft operations; the change in DNL by 2001 may be considerably smaller, thus necessitating greater accuracy in the conversion to ANEL. We find that the Port's Noise Validation Method would only be a reliable method for determining whether the future ANEL goals have been met if it is revised to incorporate the input from the six supplemental monitoring sites, as indicated

in our January 9, 1995 Noise Order, and any additional monitoring sites the Port may establish, with a full accounting for statistical uncertainty in the measured data at all sites.

With respect to the Nighttime Limitation Program, the aircraft operation data compiled by the Port show that its current goals have been met. We note that the number of exemptions is small and the number of variances issued has dropped substantially over the past few years. The Port's expressed attitude about continuing to minimize Stage 2 nighttime operations is encouraging.

Most of the elements in the Ground Noise Control Program have also been accomplished. Powerbacks have been prohibited and are not occurring. The need for use of auxiliary power units has been reduced. The Port is on record that it will pursue a "hush house" if an additional maintenance base is developed at the Airport. We did not hear, however, about actions to reduce reverse-thrust noise upon aircraft landing, as stipulated in the Noise Mediation Agreement.

We find that the improvements to the Duwamish/Elliott Bay Corridor Noise Abatement Procedures anticipated in the Noise Mediation Agreement have not been fully developed or implemented, especially with regard to periods of "low activity" as called for in the Agreement. We also note that the current nighttime departure corridors over Elliott Bay/Puget Sound have a low compliance rate.

The Noise Management System component has been implemented. There is some question about the status of the program to Control Noise from Most Annoying Operations, which is intended to "control or eliminate particular single event operations that occur on a continuing basis and that are the object of community complaints." That program has three elements: (i) improvement of the Port's Aircraft Noise Hotline procedures to crosscheck noise complaints; (ii) use of the Noise Management System, and/or assistance from the FAA, to identify the specific operation or event that prompted the complaints; and (iii) a commitment that the Port will contact the airline or the FAA "to make the parties aware of the specific noise concern and to attempt to reach a solution." From the record before us, it appears that the Port is carrying out that commitment with respect to initial departure only; in addition, it is not clear how cooperative the airlines and the FAA have been in taking action to adjust or discontinue the operations/events that provoke complaints, or how effective the program has been in actually controlling or eliminating such operations and events.

Turning to the NMA's Noise Remedy/Mitigation Program, our review indicates that, with the exception of the insulation of public buildings (most notably public schools in the Highline School District), most of the Port's essential milestones have been reached thus far, and additional mitigation has been scheduled and pursued, as described below.

The planned Acquisition/Relocation Program, a major element of the Noise Remedy Program, was largely completed by 1993; the Port purchased the last few properties by 1995, accomplishing a total buy-out of some 1,400 properties in the most severely noise impacted areas.

Prior to the NMA, the Port was insulating 175 houses a year. At that rate, it would have taken more than 50 years (to the year 2040) to complete the insulation of the 10,000 homes now deemed eligible for insulation treatment. The Residential Insulation Program adopted as part of the NMA called for the Port to insulate 350 houses per year; at that rate it would still have taken about 27 years to complete the needed work. In mid-1993, the Port greatly accelerated the

residential program, and it is now proceeding rapidly (at a rate of about 110 homes per month). By December 1995, the Port had insulated 3,647 houses.

The Audit Procedures for the insulation program have been implemented. The Cost Share Program has been replaced by the standardized insulation program, as approved in the 1993 Part 150 Update. However, the Mobile Home Program has seen little activity, and we have not been told of the existence of the report on possible mitigation actions for mobile homes called for in the Agreement. For reasons that are not entirely clear, there has also been relatively little activity with respect to the Transaction Assistance Program. We are not convinced that the Port is pursuing this program as effectively as it could.

Our chief concern with the Noise Remedy Program involves the insulation of sensitive-use public buildings, including the public schools (where progress has been delayed due to an impasse with the Highline Public School District). In addition, the Noise Mediation Agreement envisioned an insulation program that would cover a broad range of public buildings; it called for the Port to "[e]xpand [the] existing program to provide insulation for additional types of public buildings (e.g., auditoriums, private schools, churches, day care centers, libraries, etc.)." At present, this component is limited to insulation of classrooms at Highline Community College, now underway, and pilot projects at two churches, one private school, one condominium and one convalescent home. For reasons that are more fully discussed below (in the section of the Decision dealing with noise mitigation actions), we find that the Port's compliance with this portion of the Noise Remedy Program is incomplete.

Although the insulation of sensitive-use public buildings is a critical aspect of noise mitigation and we have very serious concerns about the lack of progress in this area, we have concluded, on the basis of the Port's successful efforts to meet or exceed the requirements of most of the other abatement and mitigation measures stipulated in the Agreement, that the Port is in substantial compliance with the Noise Mediation Agreement. Accordingly, we find that, on balance, the Port has met its burden under the Resolution to show that it is satisfying its basic obligations under the Agreement. We note that this finding does not necessarily imply that the programs pursued under the Agreement have been effective in reducing "real noise impacts."

III. APPROPRIATE BASE YEAR

For the reasons stated in our January 1995 Noise Order and reiterated during the hearings in May 1995, the Panel found that it was appropriate to use 1993 as the base year for purposes of the noise reduction condition imposed by Resolution A-93-03. The Resolution does not by its terms establish a base year, and in the absence of *any* expression in the Resolution that the General Assembly itself meant to look to the past for reductions in noise impacts, it would be highly irregular to interpret the Resolution to establish a retrospective test. The Panel said, however, that we would consider improvements in noise impacts achieved before the Resolution was enacted in assessing the significance of the reductions scheduled, pursued and achieved since 1993.

The Port has consistently maintained that 1989/1990 — the "year" immediately preceding the Noise Mediation Agreement — should be used as the base year for purposes of comparison. We have not accepted this position. In its February 1996 Position Statement, however, the Port offered for the first time a new argument that even if the Panel was correct when we concluded in January 1995 that the Resolution should be interpreted to require a meaningful reduction in noise impacts

after it was enacted, the Panel should have used 1992, rather than 1993, as the base year because the Resolution was passed in April 1993. By taking 1993 as the base year, the Port claimed, the Panel gave it no credit for improvements realized during 1993.

The Port contends that the consequences of the Panel's interpretation were magnified by the coincidence of a significant but transitory reduction in operations at the Airport and a resulting drop in airport-generated noise during 1993 -- a distortion which was then compounded, the Port argues, by a sizable increase in operations at the Airport in 1995. As a result of these aberrations, the Port maintains, the use of 1993 as the base year for comparison with 1995 made it very difficult to show a significant change in noise impacts. Accordingly, while reserving its claim that 1989/1990 is the proper base year, the Port urged the Panel to consider the reductions in noise impacts achieved since 1992, rather than 1993. The ACC responded that the Port's argument came too late, that the Port should have offered April-to-April, rather than calendar year, estimates (to reflect exactly the timing of enactment of the Resolution), and that in any event, the changes in noise impacts since 1992 relied upon by the Port are not sufficient to satisfy the requirements of the Resolution.

We have examined the Port's new argument carefully. We find that, although total Airport operations declined in 1993, air carrier operations did not -- and air carrier operations are the driving force behind the noise generated at Sea-Tac. The air carriers account for the majority of the Airport's operations, and the aircraft they use are noisier than commuter aircraft: 2 dB to 12 dB (SEL) louder on arrival, and up to 23 dB (SEL) louder on departure. Air carrier operations have declined in only one of the past seven years: 1991, not 1993. Decreases in air carrier operations do affect airport noise, but no such decrease affected the Sea-Tac Airport noise levels in 1993. In addition, the sharp increase in carrier operations in the first few months of 1995 (instigated by the introduction of Southwest Airlines' new service) subsequently settled back to levels more consistent with the long-term rate of growth.

However, the Port's persistent objections to the selection of a 1993 base year (which were echoed by some members of the PSRC's Executive Board), and our own serious concerns about the potential distortions that could be introduced by the selection of short-term intervals for examination, have led us to review Airport noise levels over the entire ten-year period from 1986 to 1995, using data provided by the Port.* These data show that the 1989/1990 base period preferred by the Port was the single loudest "year" in the past ten years, as measured by the Port's 11 permanent remote monitoring station (RMS) sites and reported in the 1991 Noise Mediation Committee Technical Report and the 1996 Port Compliance Report. Consequently, selecting 1989/1990 as the base period would exaggerate the long-term effects of noise abatement on the neighboring communities.

During that ten-year interval, the sound level changes at the Airport, as reported by the Port, show a reduction in aircraft DNL of 0.9 dB since 1993, 2.3 dB since 1992, 3.4 dB since 1989/1990, and 2.8 dB since 1986. The overall change since 1986 (-2.8 dB DNL) masks some substantial fluctuations in the actual rate of change; there was no reduction in average DNL at the 11 permanent RMS sites in the five-year period between 1986 and 1991, for example, and there was very little change from 1993 to 1995.

* Data on aircraft DNL in 1987 was not available to the Panel.

To avoid biasing our analysis by overstating or understating the trend in noise changes over time, we have decided to take a comprehensive approach. We do not wish to permit the selection of a base year -- a choice that is inevitably arbitrary in some respects -- to prejudice the outcome of this proceeding, and we have therefore examined the results of the Port's noise abatement and mitigation programs over all three periods: since 1993, since 1992, and since 1989/1990.

As this Panel stated in the January 1995 Noise Order, "We are convinced that the Resolution was intended to condition the approval of the third runway upon a showing that the noise impacts of the existing Airport have been reduced in a significant way." Accordingly, we have carefully evaluated all of the evidence presented to us, for each base-year period, in order to determine whether the Port has, in fact, successfully "scheduled, pursued, and achieved" a meaningful and perceptible reduction in real, on-the-ground noise impacts for the people in the communities surrounding the Airport. We present our detailed evaluation below, reporting the specific results of our analytical work for the benefit of the PSRC, the Port, the communities affected by airport noise, and other interested parties.

IV. EFFECTIVENESS OF NOISE ABATEMENT PROGRAMS

The Port argues that its noise data showing reductions in actual, measured, on-the-ground A-weighted sound levels are accurate; that the measured reductions can reliably be converted, through modeling and estimation, into reductions in numbers of people "highly annoyed" by airport noise, speech interference, sleep disruption, incompatible land use, etc.; and that the change in "noise impacts" can be then converted into credible estimates that several thousand people have received non-trivial benefits from the noise reductions, thus demonstrating that the Port has successfully met the requirements of the Resolution.

The ACC has urged that the Panel reject the Port's claim to have achieved a significant or meaningful reduction in noise impacts since 1993 for two related reasons: (i) the analytic tools used to derive the Port's estimates have not been shown to be accurate in measuring changes in noise impacts from small changes in noise levels; and (ii) the reported reductions in measured noise levels and impacts have been too small to be appreciated by the residents of the communities surrounding the Airport.

Reliability of Estimates

The Port presents various estimates of the changes in noise impacts associated with the measured and computed changes in DNL, SEL, and TA since 1993, 1992, and 1989/1990, in terms of numbers of people experiencing annoyance, speech interference, sleep disturbance, and other on-the-ground noise impacts. These estimates are subject to several layers of potential measurement and estimation error: (i) in the initial calculation of the changes in aircraft DNL based on measured SEL data from the permanent and supplemental monitoring sites; (ii) in the application of the revised dose-response Schultz Curve recommended by FICON ("FICON Curve") to estimate noise impacts; and (iii) in the adjustment and application of the Integrated Noise Model ("INM") to estimate DNL contours and the numbers of people benefitted by reductions in noise impacts.

The Panel acknowledged, when we requested the Port to expand its monitoring sites, to supplement its DNL analysis with the additional SEL and TA metrics, and to document its estimates of changes in on-the-ground noise impacts, that the process would "inevitably require the Port to

back-calculate or otherwise estimate some of the required inputs" and that this "would introduce some imprecision into the exercise."

We did not, however, excuse the Port from the burden of addressing the extent and impact of that imprecision. We expected the Port (i) to present information on confidence intervals to support the statistical reliability of its data, (ii) to document the assumptions and adjustments it made when it applied the FICON Curve and the INM to estimate changes in DNL contours, numbers of people benefitted, and other noise impacts, and (iii) to perform sensitivity tests, where appropriate, to evaluate the effects of those assumptions. In the December 18, 1995 letter that accompanied our Preliminary Order on Phase II Noise Issues, for example, we asked the Port to "clearly and completely document every assumption and adjustment it has made in calibrating the INM as used in its Compliance Report." We repeatedly requested confidence intervals and sensitivity tests in the course of the hearings. The Port did not supply that information.

In response to the Panel's questions at the February 1996 hearing, the Port presented some partial details on the confidence intervals for its 0.9 dB reduction in aircraft DNL since 1993. The Port stated that, for the DNL measurements at the permanent RMS sites, the 95 percent confidence intervals were plus or minus 0.2 to 0.4 dB. At the supplemental monitoring sites, the intervals were much wider: "in the neighborhood of" plus or minus 1.5 dB, according to the Port's noise consultant. In other words, the actual change in aircraft DNL since 1993 (per the Port's permanent monitoring sites only) may be as large as -1.3 dB or as small as -0.5 dB; and the change in aircraft DNL at the supplemental sites is not known.

This risk of DNL measurement error is a function of several factors: the possibility of very small inaccuracies in the measurement system calibration over time; the more important fact that noise impacts can vary considerably with slight changes in topography and distance from the noise source; the accuracy with which the system can separate aircraft noise from other sources; and, for the supplemental monitoring sites, the use of data from sample weeks rather than 365 days of measurements to compute measured DNL at the sites.

The principal analytical tools the Port used to translate its measured DNL reductions into on-the-ground noise impacts were the FICON Curve and the Integrated Noise Model.

The FICON Curve, based on the noise dose-response relationships reported from many surveys, is an accepted "model," or method, of estimating noise impacts on populations from changes in measured noise levels (DNL). In making use of the FICON Curve, however, the Port did not take account of the margin of error inherent in the curve. The surveys on which the FICON Curve is based are subject to two kinds of measurement error: error in the physical measurement of the noise (i.e., whether the instruments registered the same levels of noise experienced by the population), and error in the survey reports. Green and Fidell address these issues in an article accompanying the widely accepted 1991 update of the original Schultz Curve by Fidell, Barber and Schultz.* Green and Fidell estimate that the measurement error in the noise variable is 1 to 3 dB, and that the measurement error in the survey reports translates into a 4 dB range in the noise

* D. Green and S. Fidell, *Variability in the Criterion for Reporting Annoyance in Community Noise Surveys*, *J. Acoust. Soc. Am* 89 [1], January 1991; and S. Fidell, D. S. Barber, and T. Schultz, *Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise*, *J. Acoust. Soc. Am* 89 [1], January 1991.

variable. They estimate that these errors, together, amount to approximately 5 dB. In other words, DNL differences of less than 5 dB fall within the FICON Curve's margin of error and therefore cannot be used to make reliable estimates of differences in the percentage of the population which is "highly annoyed" by aircraft noise impacts.

Neither the -0.9 dB DNL change reported at Sea-Tac since 1993, nor the -2.3 dB or -3.4 dB DNL changes since 1992 and 1989/1990, approaches the 5 dB margin of error in the FICON Curve. Thus, the estimates of the population effects which the Port derived from the FICON Curve are not statistically reliable. The model is simply not sensitive enough to produce dependable estimates of reductions in noise impacts from such small changes in DNL.

Another way to understand this point is to examine the 95 percent confidence interval around the FICON Curve, which Fidell, Barber and Schultz (1991) calculate. Although the width of the confidence interval varies along the Curve, at the mid-range of the FICON Curve, for a given DNL, the 95 percent confidence interval is nearly 20 percentage points wide. For example, at a DNL of 70 dB on the FICON Curve, we can be 95 percent certain only that the percentage of the population "highly annoyed" by aircraft noise is somewhere between 15 and 35 percent.

The Integrated Noise Model is a complex, FAA-approved computer model used to calculate the land areas impacted by aircraft noise (DNL contours in square miles), and the corresponding numbers of people affected by aircraft noise within various DNL contours. The INM is a standard analytical tool, but the outputs of the INM depend on the specific values the analyst assigns to the input variables. Despite the Panel's specific request, the Port failed to supply detailed information on the assumptions and adjustments it used when it applied the INM to compute changes in (i) DNL contours and (ii) the population adversely affected by noise, from the measured SEL data for each aircraft type. It was not enough for the Port to present, for the first time, at the final hearings in February 1996, tables comparing measured and modeled DNL differences at each monitoring site, with no analysis of the potential effects of these differences on the population estimates and noise impact reductions the Port had derived. Without clear documentation of all the adjustments the Port made to its INM input files, it is very difficult to assess the reliability of the Port's estimates of reduced noise impacts and corresponding population benefits.

Noise analysts frequently must make assumptions in running the INM computer program or otherwise estimating the impacts of noise exposure on an affected population. In such cases, one can use sensitivity tests, in turn, to evaluate how much a change (or a measurement error) in a key input value or assumption might affect the outcome. The Port presented no reports on the results of any sensitivity tests it may have conducted. In short, we do not know what assumptions the Port used in this application of the INM, or how much difference it might have made if the Port had decided to use a slightly different set of assumptions to compute its estimated changes in noise impacts and benefits.

These various types of measurement and estimation error can cascade through the modelling and estimation process, compounding the uncertainty of the final results. Small changes in estimated noise impacts may be a product of the degree of error incorporated in the modelling process, rather than any actual change in on-the-ground noise impacts. Absent the kind of information that would permit us to independently assess the reliability of the Port's estimates, we are left with the possibility that the noise impact results the Port is estimating may very well be smaller than the cumulative measurement error in the Port's methodology.

Our concern about the propagation of error in the Port's analysis does not reflect a normative judgment that the Port made a mistake or did something wrong in its analysis (other than its failure to document the uncertainty in its data and the effects of that uncertainty on its results). Rather, our concern reflects (i) the fact that analytic tools like the FICON Curve cannot provide robust estimates of the population impacts of the small reductions in DNL that were measured by the Port, and, more specifically, (ii) the fact that the Port did not specify the confidence intervals on its data, the INM inputs, assumptions, and adjustments it made, or the sensitivity test results that would allow us to place reasonable confidence in the Port's conclusions about noise impacts.

The Port argues, with some force, that the Panel should at least accept the approximate magnitude of the results it has derived, even if we reject the appearance of precision as unjustified. The Port claims that in order to control for the risk of error, it has systematically biased its assumptions and adjustments to minimize the apparent reduction in noise levels, and associated noise impacts, over time. This claim, however, is difficult to accept without a complete description of the actual assumptions and adjustments the Port made. More persuasively, the Port emphasized that the direction and pattern of changes in noise levels and noise impacts that it has estimated are consistent with the relatively reliable measurements taken at the Port's permanent monitoring sites and with common understanding of the two underlying phenomena that have caused the most significant changes in the Airport's noise environment in recent years: the dramatic reduction of Stage 2 aircraft operations, especially at night, during the years 1989/1990 to 1995, and the marked growth in Stage 3 aircraft operations since 1993.

The Port points out that one would expect, in these circumstances, to see a continuous reduction in DNL over those years; a reduction in the loudest aircraft events, measured by SEL, with a corresponding reduction in average SEL and Time Above 85 dB; and, beginning in 1994, an increase in Time Above 65 dB caused by the increase in flight operations (now running at more than 1,000 flights per day, up 14 percent from 1993). Since this is exactly the pattern that emerges from the Port's noise measurements (and back-calculations), the Port argues that its analysis of noise benefits "makes sense" and should be credited by the Panel. While these arguments have some intuitive appeal, they were ultimately not convincing, in light of our detailed analysis of the Port's noise metrics and estimated population benefits.

We have examined with great care each of the Port's specific arguments about on-the-ground noise impacts and its calculations as to numbers of people benefitted by noise reductions. Wherever possible, we have reviewed and analyzed the underlying data. In general, we find that the underlying data show no serious internal inconsistencies across the various noise metrics; for purposes of analysis, therefore, we accept the Port's DNL, SEL, and Time Above data as generally (if not precisely) reflective of the actual changes in fleet mix and pattern of operations at the Airport. The critical question is what those data actually demonstrate, in terms of meaningful or significant reductions in real, on-the-ground noise impacts.

The Port urges us to accept its interpretation of the data with regard to noise impacts. The ACC and the RCAA urge us to reject that interpretation. We have conducted an independent evaluation, as Resolution A-93-03 explicitly requires. We present, below, our analysis and findings with respect to each of the major types of "noise impacts" addressed in the Port's Compliance Report.

Percentage Highly Annoyed

Noise impacts are often evaluated in terms of changes in the number and percentage of people "highly annoyed" by a given noise source. In its Compliance Report, the Port estimated that some 28,000 people were "highly annoyed" by Sea-Tac Airport noise in 1989/1990, out of a total population of 250,000 to 300,000 people within the 55 dB DNL contour at the time. The Port asserted that the reductions in aircraft DNL at Sea-Tac have produced a 11 percent decrease since 1993 -- and a 33 percent decrease since 1989/1990 -- in the overall number of people "highly annoyed" by aircraft noise: 2,100 fewer since 1993, and 9,900 fewer since 1989/1990, by the Port's estimates.

At the end of the final day of the February 1996 hearing, in response to the Panel's questions about the basis for those statements, the Port supplied the following table to substantiate its estimates of fewer people "highly annoyed:"

PORT ESTIMATES: PERCENTAGE OF PEOPLE HIGHLY ANNOYED

DNL CONTOUR BAND	1989/90	1993	1995
75 dB and above	45	36	34
70-75 dB	29	22	20
65-70 dB	17	12	11
60-65 dB	9	6	6
55-60 dB	5	3	3
OVERALL PERCENT HIGHLY ANNOYED	9	7	6

(Note: The overall percentage highly annoyed reflects a weighted average of the number of people affected by airport noise in each DNL contour band; there are very few people in the 75 dB DNL contour, but many in the 55, 60 and 65 dB contours. 1992 is not included because the Port supplied no estimates on percent highly annoyed in 1992.)

We were then able to trace the logic behind the claim. The Port had placed its reported changes in aircraft DNL on the FICON Curve, calculated a corresponding overall percentage of people "highly annoyed" in 1989/1990, 1993, and 1995 -- 9, 7, and 6 percent, respectively, of the population within the 55-dB-and-above DNL contour -- then multiplied those percentages by its INM population estimates and compared the results with the original estimate of 28,000 people "highly annoyed" in 1989/1990, in order to arrive at its figure of 9,900 fewer people "highly annoyed" in 1995.

That would have been a positive benefit, if we could reasonably conclude that it had actually occurred. Unfortunately, the entire calculation was based on very small movements along the FICON Curve: a shift of -0.9 dB DNL since 1993, and -3.4 dB DNL since 1989/1990, along a curve that does not accurately predict changes in annoyance for DNL changes of less than 5 dB. There is a very large potential for error when one uses the FICON Curve to estimate the percentage of "people benefitted" from very small reductions in DNL; as noted earlier, the 95 percent confidence interval is about 20 percentage points wide. Because the percentage changes the Port computed in its table -- the shifts from 9 to 7 to 6 percent of the overall population -- have no solid basis, one cannot conclude that there has been any change at all since 1993 in the actual number or percentage of people "highly annoyed" by aircraft noise, or more than an insignificant change since 1989/1990.

Consequently, we cannot find that the Port has demonstrated any significant "noise impact" benefits on the basis of its "highly annoyed" population analysis. Contrary to the Port's assertions in the Compliance Report, the actual data are, instead, consistent with the findings of the ACC's 1995 social survey that the majority of residents do not perceive a reduction in annoyance due to aircraft noise impacts.

The ACC social survey results, covering six communities in the vicinity of the Airport, indicated that (i) people in the Sea-Tac area are generally more tolerant of aircraft noise than people elsewhere in the country where such surveys have been done, and (ii) an average of 30 percent of the respondents were more annoyed by aircraft noise over the past two years (February 1993 to February 1995), while an average of 9 percent were less annoyed. The Port criticized the survey technique (which asked respondents to remember a noise situation two years prior and to compare it to the current time period) and offered expert testimony by Dr. Ward discounting the reliability of memory. On review, we find the survey a useful device, conducted by a leading expert on such surveys. Because the technique differed from the usual methodology of asking respondents to describe the then-current situation at two different times and then independently comparing the answers (no such prior survey was available for the Sea-Tac area), we accept the survey's results on the change in annoyance as illustrative rather than definitive. We note that the ACC's survey results are consistent with the relationship between DNL and Percentage Highly Annoyed expressed in the FICON Curve for noise impacts.

Loudest Aircraft: SEL Analysis

The Port also presents data on individual aircraft noise events in terms of Sound Exposure Levels (SEL). There *has* been a reduction in the highest-noise-level aircraft events, as measured by the Port's SEL data and the aircraft operational data for the changing fleet mix at the Airport.

From 1993 to 1995, the total number of Stage 2 flight operations at Sea-Tac declined from 132 per day to 93. Moreover, by 1995 the majority of the remaining Stage 2 planes were F28s, which are measurably quieter (by 5-7 dB SEL) than the Stage 2 Boeing 727s that dominated the noise profile in 1990 and were still the dominant Stage 2 aircraft in 1993. At night, the average number of Stage 2 operations dropped from 20 in 1993 to 9 in 1995; only a handful remained by the end of 1995 (due to the October 1995 deadline in the Nighttime Limitations Program).

In recent years, however, the change in average SEL has been small. We find that the overall fleet-wide average SEL reduction of 2.0 dB since 1993 is too small to produce a meaningful change in on-the-ground noise impacts, especially when coupled with more flight operations. Further, any assessment of the reliability of that figure is complicated, in part, by the range of variation in measured SEL values over various aircraft types and even within individual aircraft categories. We also find that there was relatively little reduction in the number of peak aircraft noise events with a SEL over 95 dB (averaged over the 11 RMS sites) from 1993 to 1995.

Moreover, the Port's data show an *increase* since 1993 in aircraft noise events with an average SEL over 85 dB at the 11 RMS sites (with only a slight decrease at the supplemental sites). There has also been an increase in the number of aircraft events with an average SEL over 75 dB at both sets of sites. The Port did not supply 1992 average SEL data for the Panel's analysis.

Since 1989/1990, there has been an overall 4.5 dB reduction in average SEL for individual aircraft events. That change, which reflects the early phase-out of Stage 2 aircraft at Sea-Tac, would appear to be "significant" and "appreciable," in the sense that people should be able to notice a difference of that magnitude and perceive some benefit. The extent to which residents actually do perceive a difference of 4.5 dB SEL in the average level of individual aircraft events over the course of a six-year period may be tempered, however, by the unreliability of memory (as the Port noted in its criticism of the social survey), and by the countervailing effects of an increase in the number of daily aircraft operations over the same period.

Federal regulations require the phase-out of all Stage 2 operations by 2001. The Port produced earlier benefits for the Puget Sound Region by accelerating the phase-out of Stage 2 aircraft in the early 1990s; 86 percent of the fleet was Stage 3 by 1995. In effect, residents obtained the benefits of the drop in peak SEL (aircraft events above 95 dB) sooner than they otherwise would have, as Sea-Tac outpaced the national phase-out of Stage 2 aircraft. While that early improvement was certainly beneficial, we find that the gains the Port achieved (reflected in reductions in average SEL) are now being eroded by the growth in operations, as the following evaluation of the Time Above (TA) data indicates.

Speech and Activity Interference: Analysis of Time Above

One of the most useful and illuminating ways to assess changes in noise impacts is the Time Above (TA) metric. The Port uses this measure to estimate changes in speech and activity interference (and corresponding numbers of people benefitted) from data on the changes in daytime TA 85, 75 and 65 dB outdoors, and changes in daytime TA 60 dB and 45 dB indoors. While the TA metric is measured directly from the Port's RMS and supplemental monitoring sites, the Port's estimates of the number of people benefitted must be viewed with the same cautions raised previously about the accuracy of the INM-estimated population data.

Because the Port provided no Time Above data for 1992, our analysis is limited to the 1993-1995 and 1989/1990-1995 time periods. Except where noted below, the Port presented data on TA "per day" based on a 15-hour daytime "day."

We evaluated the significance of the reported reductions in Time Above in terms of minutes per day, as well as percent change. For example, in the 1993-1995 time period, the large percentage reductions in daytime TA 85 that the Port cites in its Compliance Report **actually represent decreases of less than two minutes per day in noise exposure above 85 dB, while the small percentage increases shown in TA 65 amount to as much as an additional 44 minutes per day of noise exposure above 65 dB.**

When we examined the longer 1989/1990-1995 interval, we found a similar pattern. The average daytime Time Above 85 dB at the reported monitoring sites fell from about five and a half minutes a day in 1989/1990, to just under two minutes a day in 1995. The average Time Above 65 dB remained much the same: 2 hours and 53 minutes in 1989/1990, compared to 2 hours and 38 minutes six years later.

It is difficult to conclude that such small reductions in average TA 85 constitute a meaningful reduction in "real noise impacts." How much weight should one give to the decreases in Time Above 85, in evaluating population exposure to aircraft noise? Removing a large share of the loudest

aircraft noise does make a difference in on-the-ground noise impacts. But recent increases in Time Above 65 dB are now partially offsetting the reduction in the peak aircraft noise (TA 85). If one takes the "equal energy principle" at face value -- a ten to one noise-energy tradeoff for a 10 dB difference, one hundred to one for a 20 dB difference, etc. -- then as of 1995, with respect to operations at Sea-Tac, the decreases in TA 85 still outweigh the increases in TA 65, implying an overall net benefit (as the small but continuing reduction in DNL suggests). We view that tradeoff with some circumspection, however, especially as TA 65 grows further into the "several hours per day" range. At that point, the real-world relationship between aircraft noise levels and number of operations comes into play. The pattern of aircraft noise at a site in the community has fewer very loud peaks but becomes far more continuous, and a steady stream of aircraft noise above 65 dB has noise impacts of its own.

For the three RMS sites where the Port presented 24-hour (rather than daytime) measured TA data from the Port's noise monitoring system -- RMS sites 5, 10, and 11 -- the Time Above 65 dB in 1995 was 5 hours per day at RMS 5; 3 hours and 51 minutes per day at RMS 10; and 9 hours and 49 minutes per day at RMS 11. At all three sites, Time Above 65 dB is now higher than it was in 1993, and at RMS 11, TA 65 is also higher than it was in 1989/1990.

Moreover, at one site -- RMS 11 -- TA 85 was also higher in 1995 than it was in 1993. The increase in TA 85 from 9.5 to 10.4 minutes per day at RMS 11 indicates an increase in the loudest aircraft events, perhaps as a result of increased aircraft ground noise.

Our examination of the TA data suggests that the Port may have already obtained most of the net benefit it can expect from the reductions in TA 85 produced by its current noise abatement programs. It appears to the majority of the Panel that the Airport may have reached a plateau in net noise reduction, or will do so shortly, because TA 65 is now increasing steadily, and the earlier downward trend in TA 75 has apparently bottomed out as well. With the rising number of flight operations, the number of minutes (or hours) of Time Above both 65 dB and 75 dB is likely to rise in future years, soon overtaking the real benefits of the Port's reductions in TA 85.

We note that Time Above 65 dB -- not to mention 75 dB -- does more than merely cause "low levels" of speech interference; it disrupts a wide variety of everyday activities (relaxation, thinking, reading, learning, and listening) and is correlated with increased levels of stress, tension, and annoyance. The Port cites the 1992 FICON Report discounting such effects; however, since that FICON Report was issued, a considerable body of medical literature has been developed, documenting the adverse effects of exposure to noise levels in the 65 to 75 dB range, including psychological distress, loss of concentration and reading comprehension, and other physiological effects. In short, increases in outdoor TA 65 can produce serious on-the-ground noise impacts.

We also evaluated the Port's estimates of indoor speech and activity effects based on changes in interior TA 45 in single-family residences. The Port's data support a finding of substantial improvement in interior TA 45 for insulated buildings with the windows shut, but that is primarily a function of the insulation, not a result of improvements in the outdoor TA. (The data results do demonstrate the significance of achieving an average A-weighted sound level reduction of 7 dB for insulated houses, with windows closed.) For the open-window case, however, it appears that interior TA 45 -- a benchmark for the threshold of speech interference -- has increased, based on the trends in the outdoor TA 75 and TA 65. The Port did not specifically show the interior, open-window TA 45 dB data.

Changes in classroom speech and activity interference were assessed using interior TA 60 and TA 45. In examining the underlying data, we find that the large percentage improvements the Port shows in "medium level" speech interference from 1993 to 1995 amount to actual reductions of just two to three minutes per day. The data also show almost no improvement in the amount of time above the 45 dB threshold for speech interference. Most important, our analysis revealed the striking fact that for the four schools the Port cites, even with the windows closed, the interior noise levels are above the threshold for speech interference (45 dB) for an hour to an hour and a half per day.

Once again, marked improvement is shown when insulation is added. When the Port adjusts its estimates to reflect a 5 dB reduction in A-weighted sound level due to insulation, the number of classroom hours above that threshold noise level of 45 dB are cut in half — still disruptive to the learning process, but much better. These results underscore the critical need for school insulation, because a continued increase in aircraft operations in the future will only increase the number of minutes (or hours) over the threshold for speech interference.

Nighttime Noise Improvements

The Port also presented data and analysis on the change in the potential for sleep disturbance. We note that because the method of analysis is new and untested, the Port's results should be viewed with caution, especially in light of the concerns outlined above about the reliability of the Port's INM-estimated population benefits. The method does seem plausible in its approach and its use of the USAF curve on probability of awakenings.

The reported 1.9 dB reduction in the average SEL of nighttime events since 1993 is not a meaningful indication of changes in real, on-the-ground noise impacts, and the reliability of that figure is complicated by the range of variation in the measured SEL data across and within aircraft categories. The reported decreases in nighttime L_{90} in recent years are small as well: -0.9 dB since 1993, -1.9 dB since 1992, and -3.6 dB since 1989/1990. It appears to the majority of the Panel that the small size of the reductions may be due to a combination of three factors: (i) the increase in the number of nighttime flight operations; (ii) the fact that the wide-body Stage 3 aircraft, with the exception of the Boeing 767, have the highest A-weighted sound levels on arrival -- greater than a Stage 2 Boeing 727; and (iii) the fact that, on departure, the wide-bodies and the hushkitted/re-engined 727s and DC8s are within 3 to 6 dB (SEL) of the Stage 2 Boeing 727. Although there are now far fewer Stage 2 flights at night, the total number of nighttime flight operations is not declining. The Port's data show an average of 133 flights per night in 1989/1990, 120 per night in 1993, and 138 per night in 1995 (data on 1992 nighttime operations were not reported).

The Port's analysis shows a modest decrease in the overall potential for awakenings since 1993, which is attributed mostly to the home-insulation program (discussed later in this Decision). With the windows closed, insulation does work. Our analysis of the data, however, shows an increase in the number of potential awakenings for the open-window case, which suggests that the increase in total nighttime operations is overriding the decrease in average aircraft SEL produced by the nighttime Stage 2 phase-out.

Moreover, we are concerned about the Port's decision to use a 5 percent open-windows assumption in its analysis (i.e., the Port estimated the overall rate of nighttime awakenings on the assumption that residents keep their windows closed 95 percent of the time). We are not sure of

the factual basis for that assumption, or the extent to which it may have affected the Port's results. No sensitivity analysis was presented, although we would expect that the difference in noise exposure with open v. closed windows has an important bearing on the rate of nighttime awakenings.

The effectiveness of the Port's nighttime noise abatement programs is being undermined to some degree by poor aircraft compliance rates on the North Flow Noise Abatement Departure Corridors. We commend the Port for its actions in implementing these Corridors; it is clear that such flight track procedures can have a significant impact on population noise exposure. But they produce results only if they are enforced. While compliance with the nighttime Corridor procedures is fairly high on initial departure, we find that the compliance rates are unacceptably poor outside the immediate vicinity of the Airport. In December 1995, for example, significant numbers of aircraft failed to comply with the North Flow Corridors at night: 29 percent on the Elliott Bay Departure, 25 percent on the Puget Sound Departure North, and 27 percent on the Puget Sound Departure South. For the third quarter of 1995, the failure rates for those three Departure Corridors were 21 percent, 19 percent, and 40 percent, respectively. By comparison, the noncompliance rates for the nighttime South Flow Puget Sound Arrival Corridor were 1.4 percent in December 1995 and 0.6 percent in the third quarter of 1995.

Primary responsibility for this problem rests with the FAA, which has operating authority over the more distant sections of the Corridors. In light of the specific language in Resolution A-93-03 requesting the FAA to do more to reduce the noise impacts associated with the Four Post Plan, we find it troubling that the FAA would hinder the Port's noise reduction efforts by failing to enforce the *existing* abatement departure procedures. The Port and the residents of the Region deserve better.

We are also concerned that Alaska Airlines has shifted its two nighttime Stage 2 cargo arrivals and departures to Boeing Field ("King County International Airport" or "KCIA") in order to sidestep, rather than comply with, the Port's nighttime limitations on Stage 2 flights — a move which, we recognize, is outside the Port's jurisdiction (but perhaps not outside its influence). Taking advantage of the fact that KCIA is an unregulated general aviation airport, not subject to the controls that govern commercial airports, the carrier continues to operate these flights. These *very* loud aircraft events have generated many complaints, and this action by Alaska Airlines weakens the effectiveness of the Port's Nighttime Limitation Program.

In light of the small reductions in nighttime SEL and Leq, the *greater* likelihood of awakenings in recent years in the open-window case, and the factors undermining the Port's efforts to reduce nighttime noise exposure, we do not find that the Port has made a convincing case that there is a significant overall reduction in sleep disruption due to aircraft noise.

Airline decisions to shift Stage 2 aircraft operations out of the nighttime period to the "shoulders" of that period -- that is, 8-10 p.m. and 7-8 a.m. -- also have implications with respect to noise impacts (the Port has acknowledged the likelihood of such shifts in the timing of Stage 2 operations). The 8-10 p.m. interval covers the bedtime hour for many children and the period of evening relaxation and early bedtime for many adults. The Apogee survey of people near Dallas/Ft. Worth Airport (which the RCAA supplied for the Panel's review) showed high levels of annoyance with aircraft noise before 10:00 p.m., due to interference with normal evening activities.

Noise Contour Analysis

Another series of measures presented by the Port relates to the "change in DNL land use and population impact." The Port asserts that the population within the high noise contour (75 dB DNL) has now dropped from 3,100 to nearly zero. From the information we have seen, it is not clear that such a reduction actually occurred in the stated 1993-1995 time frame (for example, the 1993 DNL contour map shows virtually no residential land use within the 75 dB zone). Nevertheless, the ability to say that no one is residing inside a DNL contour of 75 dB is an important marker for an abatement program; in keeping with our decision to include earlier time periods, we give the Port full credit for this accomplishment, no matter when it occurred.

Similarly, sizable reductions in the number of people inside the 65 and 55 dB DNL contours are important. The Port states that 8,000 fewer people are inside the 65 dB DNL contour since 1993, and that the population inside the 55 dB DNL noise contour is 19,000 lower since 1993, an 8 percent reduction. Both of these estimates carry with them an unknown but potentially large degree of uncertainty due to the undocumented differences between the modeled and measured DNL levels the Port used in its DNL contour calibration process in the Integrated Noise Model. As we previously explained, we are concerned about the effects of propagating errors in translating noise measurements to noise models to population benefits. Given the size (-0.9 dB) of the 1993-1995 change in DNL and the uncertainty of any appreciable change in noise impacts at that level, it is not clear that the Port's estimated changes in the 65 and 55 dB DNL contours reflect anything more than a marginal shift in levels for houses on the border of the respective contours. If, as the other measures we have examined suggest, the DNL contours have moved only marginally (or not at all) since 1993, the changes are not meaningful, and the estimates of 8,000 and 19,000 people benefitted are laden with uncertainty.

The Port also calculates the change in population exposed to indoor noise levels in excess of 45 dB DNL, reporting data for both open- and closed-window conditions, and closed-window data for both insulated and uninsulated houses. We find that the population noise exposure change resulting from the insulation program is real and undebatable in the closed-window case: These people experienced an average of about 7.9 dB reduction in interior DNL (uninsulated, 1993, compared to insulated, 1995). There is no question about the significance of a change of that magnitude (although the benefits accrue only to the residents of insulated houses, and then only when they are indoors with the windows closed).

With respect to the Port's overall indoor-population-exposure estimates, however, we have the same concerns as we did with the results for the 55 and 65 dB DNL contour analyses: the propagation of error in the population projections due to uncertainties in the underlying data and in the estimation process, coupled with a very small change in mean DNL, as discussed below. Since the Port provided no information that would permit us to judge the accuracy of its population estimates, we cannot give full weight to the Port's reported results.

Summary: DNL Reductions

The DNL metrics provide a very useful -- and widely accepted -- way to characterize overall changes in airport noise. As a summary measure based on the average noise levels of hundreds of thousands of flight operations over time, the annual DNL values incorporate, but mask, the particular variations in sound exposure and noise impacts that are illuminated by the various other

measures discussed above. Total and aircraft DNL metrics are the principal tools used to summarize the overall changes in environmental sound levels associated with airport operations; total DNL reflects the changes in noise around the Airport from all noise sources, while aircraft DNL tracks the changes in noise attributed to aircraft operations.

We find that the reported reductions of 0.9 dB and 0.6 dB in aircraft and total DNL, respectively, since 1993 -- even if they were accepted as statistically reliable -- are too small to justify any finding that there is likely to have been a meaningful or appreciable reduction in speech interference, sleep disruption, the number of people or percentage of the population "highly annoyed" by aircraft noise, land use effects, or other noise impacts. The principal analytical tool used to calculate such population effects from DNL exposure levels -- the FICON Curve -- permits no conclusions about population benefits on the basis of such a small shift in measured DNL levels. If one accepts 1993 as the legally-mandated base period for comparison, the 0.9 dB reduction in aircraft DNL is clearly too small to produce even a reliably measurable -- let alone "meaningful" -- reduction in on-the-ground noise impacts.

Likewise, we find that the use of 1992, rather than 1993, as the base year would not alter our conclusion that the Port has not shown a significant or meaningful reduction in noise impacts since the Resolution was enacted. Given the small size of the change being measured (-2.3 dB in aircraft DNL, -1.8 dB in total DNL), uncertainty remains a concern. Moreover, we are unconvinced that a sound level reduction as small as 2.3 dB in DNL, over a four-year period, can reasonably be expected to produce an appreciable reduction in the on-the-ground noise impacts experienced by the population surrounding a busy airport with rapidly growing operations.

Over the past ten years as a whole (1986-1995), there has been a change of only -2.8 in aircraft DNL as measured by the Port's RMS sites. For the reasons addressed above in our discussion of the "base year" issue, we believe the ten-year change in aircraft DNL provides the most unbiased measure of actual DNL reductions at the Airport. The *maximum* change in aircraft DNL that the Port can show, for any base "year" within that ten-year time frame, is the -3.4 dB change in aircraft DNL from the single worst year (1989/1990) to date.

The scientific literature does not establish any specific figure as a definitive DNL threshold for measuring meaningful airport noise reductions. There is debate about how important a 3.0 dB change in aircraft DNL really is. While a -3.0 dB change in DNL will shift noise contours, and thus, by some measures of effectiveness, give an appearance of importance, it reflects a change in sound levels that is not much more than barely perceptible -- and certainly not "appreciable." In terms of generating real, on-the-ground noise impact reductions that people in their yards or houses would appreciate, a -3.0 dB change in DNL would not generally be considered "significant;" it would not be considered a goal for highway or rail noise abatement programs, for example.

Consequently, if we were to use the more representative -2.8 dB change in aircraft DNL -- the cumulative improvement the Port has actually achieved over the past ten years -- we would conclude that the Port has not demonstrated a sufficient reduction in real noise impacts to meet the requirements of Resolution A-93-03.

Based on our experience, the scientific literature, and our best professional judgment, the majority of the Panel also finds that the maximum reduction the Port has shown (-3.4 dB in aircraft DNL, averaged over the 17 monitoring sites) -- although it is certainly a laudable achievement for

any airport with more than 300,000 operations a year -- is below the threshold of "meaningfulness" in terms of producing a real, appreciable, "on-the-ground" reduction in airport noise impacts for an affected population -- especially when that DNL change occurs in conjunction with an increase in operations that now produces a rising trend in Time Above 65 dB. In short, even over the six-year period the Port has urged the Panel to consider, the majority of the Panel is not convinced that the Port's noise abatement efforts have produced a sufficient reduction in real, on-the-ground noise impacts to satisfy the noise condition of Resolution A-93-03.

This finding will no doubt be controversial. The literature does not precisely define what constitutes a meaningful reduction in DNL, largely because there are so many acoustical and non-acoustical variables that can affect people's responses. (An increase in aircraft operations is one such variable that has been of concern to us here.) Addressing aircraft noise abatement, A. Harris commented indirectly on the meaningfulness of different amounts of noise reduction when he noted, "How effective a noise abatement tool is a displaced [landing] threshold? Not very -- a 4,000 foot displacement is required to obtain a reduction of 5 dB.... Even the 3,019 foot displaced runway... produces only a 3.2 dB reduction in landing noise...." (A. S. Harris, "Relative Effectiveness of Options for Reduction of Aircraft Noise Exposure around Airports," *INTER-NOISE '80 Proceedings*, p. 814, emphasis added). Both the FAA and the Wyle insulation program report for Sea-Tac note that at least a 5 dB reduction in interior noise is needed, to be noticeable. Should a 5 dB decrease in outdoor noise be viewed any differently? In highway traffic noise analyses, most State Departments of Transportation consider a 10-15 dB increase in "worst hour equivalent sound level" a substantial increase, with a 5 dB increase being noticeable (trends in DNL track trends in "worst hour equivalent sound level" to a large degree); when they consider highway traffic noise abatement, they aim for a "substantial reduction" that is at least 5 dB and typically 7 to 10 dB.

FICON illustrates the debate on the subject, quoting a conversation with W. Galloway at one point ("... in a community noise environment, the majority of a group of persons exposed to a 3 dB change in DNL as a result of a change in aircraft noise exposure would characterize the change as 'clearly noticeable'" [p.3-15]) -- but FICON then goes on to say: "Although a 3 dB change may not represent a significant impact on human health or welfare, particularly below DNL 55 dB, a change of this magnitude is considered as an indicator of the need for additional analysis" (p.3-16). The FAA has established no criterion for airport noise decreases or analysis of the community effects of small reductions in aircraft noise.

The recently issued Federal Transit Administration manual, *Transit Noise and Vibration Impact Assessment* (FTA, April 1995), cites the conclusion "by EPA and others" that a 5 dB increase in DNL is the minimum required for a "change in community response." It also notes that a two percentage-point increase in people "highly annoyed" (e.g., from 10 percent to 12 percent) is the minimum measurable change in community reaction, and that the goal of abatement efforts should be to "gain substantial reduction... not simply to reduce the predicted levels to just below the severe impact threshold" (p. 6-34). Typical rail transit noise mitigation strategies seek reductions of DNL 5 dB or greater.

Some members of the acoustical community suggest that there may be a real difference in the appropriate standard to be used to evaluate the significance of noise decreases, as opposed to noise increases. It is possible that there is a quality of "downward insensitivity" associated with small reductions in already-high noise levels -- that is, people may be more sensitive to increases than to decreases, and once sound exposure levels are high enough to create annoyance and interfere with

routine activities, it may take more than a marginal decrease in noise to "unstick" that perception and produce an appreciable reduction in noise impacts.

As noted above in our SEL and TA analysis, the evidence at Sea-Tac also suggests that the additional DNL improvements which the Port anticipates from its current noise abatement programs are likely to be overtaken by the effects on DNL of the continuing increase in operations. For that reason, we are not confident that the abatement programs the Port has "scheduled and pursued" to date will generate even small reductions in future DNL -- or produce noticeable reductions in future on-the-ground noise impacts.

V. EFFECTIVENESS OF NOISE MITIGATION PROGRAMS

However, noise abatement is not the only tool in the Port's toolkit. Noise mitigation measures can also generate important and meaningful benefits in terms of a reduction in noise impacts. We turn now to our findings and conclusions about the significance of the benefits attributable to noise mitigation.

Under the Noise Mediation Agreement, the Port made Noise Remedy Program commitments in four major areas: residential acquisition and relocation; a transaction assistance/special purchase program; residential noise insulation; and sensitive-use public building noise insulation.

The Acquisition/Relocation Program has been completed as planned, with the buy-out of some 1400 properties in the worst noise-impacted areas. The buy-out was essentially completed prior to enactment of Resolution A-93-03; with the purchase of the last few properties in 1995, the Port has declared the acquisition program closed. A buy-out of this size is a major accomplishment for any airport, and unquestionably constitutes a meaningful noise reduction benefit to the families who have been successfully relocated. (However, the buy-out has also had some negative economic and social repercussions for the adjacent neighborhoods. The comments in the 1993 AIRTRAC *Final Report: Mitigating the Environmental and Social Impacts of Air Transportation in Washington* (p. 3-35) regarding "...'dead zones' of boarded up houses and ill-maintained streets that frighten residents...." suggest the need for additional action to mitigate the effects of the buy-out.)

With respect to the Transaction Assistance Program, we note that, while it is ostensibly available to 3,000 homeowners, only 254 -- fewer than 10 percent of those eligible -- have applied to the Port for assistance to date. The low utilization rate invites the suggestion that the program is not structured in a way that homeowners find useful or equitable, or that such assistance is not widely needed, or that the Port has been less aggressive than it might be in making this assistance easily available.

The Port has done an impressive job of residential noise mitigation since 1993. The Residential Insulation Program was accelerated during 1993, shortly after adoption of Resolution A-93-03, and it is now proceeding rapidly (at a rate of about 110 homes per month). As of December 1995, the Port had insulated 3,647 homes, including 2,888 completed since the end of 1992. The interior noise reductions achieved -- an average of 7 dB in the most seriously impacted homes, resulting in interior DNL levels of 45 dB or less in post-modification audits -- clearly appear to be both noticeable and meaningful for the people affected, as one would expect from the magnitude of the reductions and as evidenced by the positive reactions of the owners of insulated homes in the worst-impacted areas. The benefits are not in question; they are partial -- indoor,

closed-window relief only -- but they are directly measurable. We conclude that the indoor, closed-window noise impact benefits are significant for most, and perhaps all, of the 8,570 people residing in the homes insulated to date.

The Port has defined 10,000 homes (with approximately 23,500 residents) as eligible for noise insulation, and has made a commitment to complete its full residential insulation program before beginning construction of a third runway. However, the Port's Compliance Report shows 14,000 "housing units" within the 65 dB DNL contour in 1995, and more than 17,000 within that contour in 1993. As noted above, with a DNL change as small as -0.9 dB, we are not convinced that the DNL contours have changed more than marginally since 1993. If the 65 dB DNL contour is not decreasing in size, expansion of the residential insulation program may become necessary, since the Port expected a decrease in the contour when it defined the present insulation eligibility criteria. We also note that Port Resolution 3125 places certain requirements on the Port staff with regard to residential insulation prior to construction of the proposed new runway and prior to its opening.

Turning to the longer periods of evaluation which the Port has advocated, we observe that, had the Port accelerated its Residential Insulation Program just 18 months sooner -- in January 1992, rather than in mid-1993 -- it could have insulated an additional 2,000 homes by December 1995: 50 percent more than it did, in fact, complete by the end of 1995. Had the Port accelerated the program three years sooner, in mid-1990, an additional 4,000 homes could have been insulated by now. Doing so would have more than doubled the number of homes insulated by December 1995, from 3,647 to approximately 7,600. The number of people benefitting from that reduction in indoor sound levels would have also more than doubled, from 8,570 to about 18,000. Instead of a Residential Insulation Program about one-third completed, the Port would have presented this Panel with an important mitigation program that was approximately 75 percent completed. We also note that the residents of those homes would have received the benefits sooner and would be enjoying them today.

We give the Port a great deal of credit for "scheduling and pursuing" the residential insulation program vigorously since 1993, but *when* the insulation is achieved does make a difference in how the benefits are weighed. By the Port's own standard, the fact that it chose to apply substantial resources to this program in mid-1993, rather than in 1990 or 1992, represents a missed opportunity to provide demonstrated, meaningful, and continuing noise reduction benefits to several thousand people. Taken alone, this increase would not satisfy the Resolution (substantial progress is needed on public buildings and multi-family dwellings as well), but it will be an essential source of future noise benefits.

The "Sensitive-Use" Public Buildings Insulation Program, another key component of the 1990 NMA Noise Remedy Program, has been partially scheduled, is being pursued, and has had some achievements. Here, the Port cites its progress on various pilot projects: two churches (2,080 people), the SeaToma Convalescent Center (515 residents), the Soundridge Condominium project (134 people), and one private school. The Port has also begun insulation work at Highline Community College. We note that the NMA did not call for insulation of multi-family dwellings, and we commend the Port for this important addition.

The pilot programs are behind schedule, however. The two churches and the convalescent home are not currently scheduled for completion until mid to late 1996. While the Compliance Report lists the completion date as April 1996, the 1993 Part 150 Update set mid-1995 as the

expected time of completion. We also note that the Port has overstated the current benefits of the community college project, by counting every person at the college (4,000 people) as receiving benefits even though the Port has completed only 22 rooms in four out of 17 college buildings.

The 1990 Noise Mediation Agreement specifically envisioned an insulation program that would include many types of public buildings: "auditoriums, private schools, churches, day-care centers, libraries, etc." The Agreement also called for field and feasibility studies for public buildings bordering the 65 dB DNL contour. The Port has not reported appreciable progress in these areas.

In addition to 23 schools, Table 1-7 of the Port's Compliance Report lists 15 hospitals or rest homes, 10 churches, and 2 libraries within the 65 dB DNL contour in 1993. The NMA did not call for the two-step approach the Port is currently using to implement the Public Buildings Insulation Program (pilot projects, followed at some point by a full program); that approach resulted from the 1993 Part 150 Update. While we respect the Part 150 process, we are not sure that pilot studies were necessary, especially for private schools. Different types of buildings do have their own peculiarities with respect to noise insulation work, but there would seem to be enough experience in the field of sound insulation for the Port to have proceeded into a full program. It appears that the larger issue holding up progress on insulation of sensitive-use public buildings and multi-family housing units may be the cost. As of the Panel's February 1996 hearing, Port staff said that they had developed a proposed budget, but funding was still "an issue."

Because insulation of public buildings and multi-family dwellings can reduce indoor DNL substantially, it offers the promise of meaningful, long-term indoor noise relief to a potentially very large number of people in the vicinity of the Airport. The pilot projects are important, but, absent a timetable for the full program and a funding commitment from the Port, we cannot conclude that this component of the Port's Noise Remedy Program is being effectively "scheduled and pursued" per Resolution A-93-03.

Finally, throughout this proceeding, we have repeatedly expressed our concern about the delays in school insulation. We find it difficult to conclude that there has been a "meaningful" reduction in on-the-ground noise impacts as long as the majority of classrooms in the airport vicinity remain uninsulated and heavily impacted by aircraft noise. The record provides ample evidence of speech interference in local schools, and with the continuing increase in the number of daytime flight operations, classroom disruption can only increase. We recognize that responsibility for the failure to move forward with school insulation projects rests primarily with the Highline School District; the Port has made its commitment to funding school insulation projects clear. The factors cited by the School District — general rehabilitation costs, lack of funds, and policy questions concerning noise insulation for older, inadequate school facilities — are legitimate issues, but do not excuse years of inaction on this critical aspect of noise mitigation.

On balance, we strongly commend the Port for its efforts in the buy-out and residential insulation programs, but find that the Port's mitigation programs have had a limited effect in reducing real on-the-ground noise impacts. For the population directly benefitted, relocation and residential insulation have provided real reductions in noise exposure (at least indoors, with the windows closed), but the number of people benefitted remains relatively small, compared to the number of people affected in the Region. In our view, both the Noise Mediation Agreement and Resolution A-93-03 clearly contemplated a broader reach of noise mitigation effects -- especially with

regard to reducing noise impacts in schools and other sensitive-use buildings -- than the Port has scheduled, pursued, and achieved to date.

VI. "MEANINGFUL AND REASONABLE" REDUCTIONS IN NOISE IMPACTS

In our January 1995 Noise Order, the Panel stated, "To meet its burden under the Resolution... the [Port] must offer us reliable evidence, based on actual measurements of on-the-ground noise, that by 1996 there has been an objectively measurable, meaningful reduction in aircraft noise impacts in the affected communities surrounding the Airport." We expressed our belief that the PSRC General Assembly, in enacting the Resolution, "intended to condition approval of the third runway upon a showing that the noise impacts of the existing Airport have been reduced in a significant way." And we set the parameters of this proceeding by stating that neither an "unreasonable" (i.e., unreachable or infeasible) nor a "meaningless" (i.e., inappreciable or trivial) reduction in noise was contemplated by the Resolution.

At the simplest level, we intended that particular wording to send a balanced, dual message, signaling the Port that this Panel would not be persuaded by insignificant changes in noise levels or noise impacts, and simultaneously signaling the community that we would not impose an unrealistic standard of noise reduction (for example, requiring a 10 dB DNL reduction). Our choice of wording echoed the language used by various members of the PSRC Executive Board in the legislative debate surrounding Resolution A-93-03, and reflected the extensive discussion at the Panel's August 1994 hearing. With our respected colleague's dissent, however, that language has taken on added weight in this proceeding.

Meaningful Reductions in Noise

In view of the plain language of Resolution A-93-03, we cannot accept our colleague's interpretation of the PSRC General Assembly's intent. That resolution, the governing document in this proceeding, sets a specific test that must be met before the PSRC will approve the third runway: Based on "independent evaluation" and on the "measurement of real noise impacts," are "noise reduction performance objectives" being scheduled, pursued and achieved? In our view, it speaks to the purpose of the Port's noise programs -- the objectives and the results. The Resolution does not ask whether the Port is performing its programs, but whether those programs are producing meaningful results in terms of the public impact of airport noise. The fundamental goal of all of the Port's noise abatement and mitigation programs, from the Stage 2 aircraft phase-out to the noise insulation at Highline Community College, is to reduce exposure to airport noise in a meaningful way -- the "real noise impacts" stated in Resolution A-93-03. The PSRC General Assembly and the Executive Board did not require the services of a panel of outside experts merely to read noise meters at the Airport, or to conduct an administrative audit to determine whether the Port was implementing the noise programs it had promised the residents of the Region.

The Resolution explicitly requires the "measurement of real noise impacts" -- not measurement of A-weighted sound levels, DNL, or SEL values, but measurement of noise *impacts* on real people and real communities. In essence, the Resolution compels the Port to document the effectiveness of its programs: the real, on-the-ground results it is achieving as it works to reduce noise impacts.

We take the Resolution's wording at face value. The use of the term "measurement" required the Port to use a combination of measured noise data and established scientific methods to document its noise reduction results in terms of "noise impacts." The phrase "real noise impacts," in turn, implies a standard based on meaningful results -- a scientifically sound, persuasive showing that the reductions in public exposure to airport noise (i) are actually occurring and (ii) are sufficient to reach at least a threshold of significance, in terms of producing documented, appreciable, and noticeable effects for the affected communities. And the requirement for "independent evaluation" meant that the Port had to demonstrate to an independent body -- the Expert Panel -- that it was in fact accomplishing meaningful results from the noise abatement and mitigation programs it has "scheduled, pursued, and achieved."

At the Panel's initial August 1994 hearing, PSRC Counsel stated that the PSRC Executive Board intended its "Implementation Steps" to be consistent with the Resolution. Accordingly, we believe the Implementations Steps also call for results, i.e., "a reduction in measurable on-the-ground noise" not merely in terms of a measurable change in aircraft SEL or airport DNL, but in the form of a measurable, appreciable, meaningful change in the public impact of airport noise. Counsel for the PSRC explicitly confirmed this interpretation, when the Panel asked, in August 1994, "Is any measurable reduction enough to satisfy the requirements of the governing instruments? Or, are we to examine the question of whether the measured reduction in on-the-ground noise represents a real noise impact within the meaning of the Resolution?" PSRC Counsel replied, "The latter."

In the Panel's December 1995 Noise Order, we emphasized that our judgment "should reflect the best insights we can gain from established scientific sources about the significance of changes in various noise metrics as indicators of changes in the impact of noise on the people in the communities surrounding the Airport." That has been our approach throughout this proceeding, as the hearing record indicates.

In light of the enormous importance of this issue for the Puget Sound Region, we believe that Resolution A-93-03 requires an impartial and scientifically accurate judgment on the substantive question before us: the effectiveness of the Port's programs in producing a meaningful change in public exposure to airport noise. That is the judgment we have presented in this Decision.

Reasonable Reductions in Noise

In reaching our findings, we have also considered the issue of "reasonableness." At a fundamental level, we do not believe that the General Assembly was "unreasonable" in expecting the Port to demonstrate that its noise programs were actually producing a meaningful reduction in "real noise impacts" for the communities surrounding the existing Airport, before launching a major airport expansion. We believe that meaningful, appreciable improvements for the population exposed to Airport noise -- real results in terms of on-the-ground noise impacts on real communities -- are achievable at Sca-Tac.

More specifically, we examined two broad interpretations of the concept of "reasonableness" in this context: reasonableness of effort, and reasonableness of results. We asked: Was this a *reasonable effort* by an airport? Was the Airport *reasonable* in deciding to do what it did? We considered: Is the *amount of noise reduction required by the Resolution reasonable*? Would a *reasonable observer* say that this Airport has done enough? Could the Airport *reasonably have done more*? We address each of these aspects in the discussion below.

Was this a reasonable effort by an airport? As the ACC argued in its October 1995 submittal: "[I]t is results, not good-faith efforts, which the General Assembly Resolution requires." In our view, the issue is not whether the Port has made an effort, even a great effort; the issue is whether there has been a meaningful reduction of impacts.

Although many of the citizens we heard from over the course of this proceeding give the Port little credit for what it has done, we fully recognize that the Port has made a serious effort in many areas, and we strongly applaud the Port for doing so. The Noise Mediation Agreement, while important to the Region, was not revolutionary in terms of the strategies it contained: nighttime operational restrictions had been in place at Washington National, Minneapolis and San Francisco; residential acquisition and residential and public building insulation were being done by many airports. Flight track changes (and preferential runway use) had produced major benefits at Los Angeles and Boston. But the Port took the initiative in the late 1980s to develop substantial noise abatement and mitigation programs at Sea-Tac and has continued them through the 1990s. Although the Noise Mediation Agreement process did not satisfy everyone, and ended rather abruptly just before the FAA implemented the Four Post Plan, it did establish major programs -- particularly the Noise Budget and the Nighttime Limitations Program -- that would be difficult or impossible to institute today, after passage of the Federal Aviation Noise and Capacity Act. In addition, the Port implemented nighttime run-up restrictions at Sea-Tac which helped to curtail that problem, and the power-back ban has answered citizens' demands, even if, as the Port admits, the latter did not appreciably reduce overall aircraft noise levels. We also commend the Port for completing an extensive Part 150 Update in 1993 and for scheduling a major effort on the next Part 150 Update in the summer of 1996. On the noise mitigation side, the Port's residential insulation program is very large, and its current rate of residential insulation work is exceptional.

We have nevertheless concluded, on the basis of all the evidence before us, that the ultimate results of these efforts, in terms of real on-the-ground noise impacts for the communities affected by Airport noise, have not been sufficient to satisfy Resolution A-93-03. Many people at the Port, including its noise consultants, have labored long and hard to develop and implement abatement and mitigation programs; substantial resources have been dedicated to the effort; yet many people in the Region remain severely impacted by airport noise.

Was the Airport reasonable in deciding to do what it did? The Port is viewed by many people, including every member of this Panel, as a leader in the field of airport noise control. The steps it has taken to date are perhaps more than "reasonable" in the sense that many other airports are doing less, and few have undertaken the type of coordinated effort the Port did in the Noise Mediation Agreement. However, the bottom line under the Resolution is results.

Is the amount of noise reduction implied by Resolution A-93-03 reasonable? Our colleague suggests that the noise reduction required by Resolution A-93-03, as we have interpreted it, is so large that it would be impossible to achieve. We disagree. For Sea-Tac, given the nature of the noise-sensitive development around the airport, a 10 dB in outdoor DNL, for example, would probably be an unreasonable reduction. This is not to argue whether 10 dB would be a desired goal, because in many instances, it is. Many highway agencies use 10 dB as a goal for their traffic noise abatement projects. Dr. Suter, serving as an expert for the RCAA, stated that 12 dB would be desirable, if one really wanted to make a difference. A.S. Harris reported a 13 dB reduction in aircraft DNL in South Boston after the implementation of the departure rerouting plan at Logan Airport, with a 76 percent reduction in people over a DNL of 65 dB (Harris, *INTER-NOISE '80*

Proceedings, p. 815). For Sea-Tac and for many airports, however, a goal of 10 dB DNL would probably be unachievable or infeasible without major structural changes in operations, flight tracks, or land uses, and hence would be interpreted in this sense as unreasonable.

But would, for example, a 5 dB DNL reduction be reasonable? Without endorsing 5 dB DNL as a benchmark, *per se*, our answer is: yes, it might very well be achievable, and thus "reasonable." Accomplishing a 5 dB reduction in DNL might be possible only with great difficulty, given the growth of operations, the nature of the Four Post Plan, and the Port's current programs. But that does not mean that the Port could not or cannot achieve real impact reduction through a variety of measures.

For example, insulation can be highly effective. A 10 dB reduction in *indoor* DNL appears both reasonable and achievable around Sea-Tac Airport. Of the houses the Port has insulated, 70 percent received an average reduction of about 8 dB since 1993 (7 dB inside and 0.9 dB outside) and 10 dB over the longer period from 1989/1990 (7 dB inside and 3.4 dB outside). Was that a reasonable noise reduction goal? Yes; and the magnitude of the change was precisely the reason why the Port was able to show, for residents of those homes, a reduction on the order of 90 percent in time lost to speech interference as well as great reductions in the potential for sleep disruption. Were those meaningful reductions in noise impacts? Yes. Were they enough, in the context of the number of homes insulated and the entire population adversely affected by airport noise both indoors and outdoors (and indoors with open windows), to tip the balance and persuade the majority of the Panel that the Port had met the test of Resolution A-93-03? They were not.

Would a reasonable observer say that this Airport has done enough? The Port argues that "[a] reasonable observer would conclude that the Resolution has been satisfied because thousands of people have received noise reduction benefits as measured by established scientific methods." We have addressed benefits and methodology elsewhere in this Decision. But who is a reasonable observer? A schoolteacher who loses 40 minutes a day waiting for planes to pass by? A business executive whose livelihood depends on airport growth? The mayor of a town under the flight path? A General Assembly member who believes the runway should be vigorously pursued? There is no definable, completely unbiased "reasonable observer" in this situation. Even the members of this Panel, as observers charged with making an independent, objective evaluation of the reductions of noise impacts, have come to differing conclusions.

Could the Airport reasonably have done more? Mr. Lewis suggests that, even if (as we have found) the Port failed to demonstrate the meaningful reduction in "real noise impacts" required by the Resolution, we should nevertheless find in favor of the Port on grounds that there was no evidence that the Port could have taken other measures that would have been expected to make a significant difference in overall noise impacts.

That is not the view we take. The Noise Mediation Agreement established a basic set of commitments; it did not preclude the Port from taking additional action. Airport noise has been an extremely contentious issue in this Region for more than 25 years, dating back at least to the construction of the second runway. As we observed earlier, the Port has long known that many people were dissatisfied with the Noise Mediation Agreement process, the FAA's introduction of the Four-Post Plan, the prospect of a third runway, and other Airport actions. Controversy, distrust, and pressure for additional action are not new. As the consultants representing the Port in this proceeding stated in their 1993 AIRTRAC *Final Report* (p. 3-35): "There is sometimes a difference

of opinion about what constitutes a commitment. For example, Sea-Tac did not complete planned land acquisition and home and school insulation programs for areas impacted by the second runway built in 1970, and this has led to a perception by some in the community of broken promises. Apparently, the airport did not consider itself bound by this plan." In 1993, by contrast, the Port took the initiative not only to meet its obligations for residential insulation but to proceed with the insulation work at a rate far faster than the pace stipulated in the 1990 Noise Mediation Agreement. That was a wise decision, in our view, and one that clearly reflects the Port's understanding that, at least in this respect, the Noise Mediation Agreement is not a limiting document: there was more the Port could and should do.

We are uncomfortable with the notion of a ruling that would turn on a speculative interpretation of what more the Port could (or could not) have done, rather than on the merits of the case. The Port did what it did — an exceptional effort in many ways, but one that fell short of generating meaningful, real reductions in on-the-ground noise impacts for the people of the communities subjected to aircraft noise. Our task is to render an informed and objective judgment on the efficacy of the Port's programs in reducing actual noise impacts, not to speculate on what else the Port might have, or could have, or should have done.

Because of the way the logic of this case has developed, however, we are now compelled to address that speculative question. Mr. Lewis believes that any additional efforts the Port might have made would not have amounted to enough to make any difference in meeting the test of Resolution A-93-03 as we interpret it. We believe that the Port could have done more, and that, had it done so, the additional improvement probably would have made a material difference in real, on-the-ground noise impacts, turned a marginal improvement into a meaningful one, and therefore affected the final outcome of this proceeding.

The issue of "what else" the Port could have done was addressed at some length in the course of the Panel's hearings. Our colleague suggests that the community groups have not met "their threshold burden" of showing how the Port could have taken additional action to produce "significantly more meaningful reductions in noise impacts." We believe that primary responsibility for proposing and developing significant noise abatement and mitigation programs rests with the Port, not with the community advocates. In this context, we note, however, that the ACC has suggested a number of additional actions, including the concept of a tradeoff linking a Federal Part 161 program that proposes some new noise abatement restrictions on aircraft operations (some capacity limits) with approval of a third runway (capacity enhancement), as a combination package to produce both improved noise relief and a net capacity gain.

The Port contends — and the entire Panel agrees — that the measures it has taken to date are the ones that were most likely to produce significant benefits, because they addressed airport noise at the source. Those measures were easier to implement than some other strategies — for example, flight track changes, which can also be highly effective in producing significant noise-impact reduction. Moreover, programs that produce smaller benefits to a large group of people or significant benefits to a smaller group of people can have a cumulative impact. Based on the discussions during the hearings, as well as the analysis in the Noise Mediation Committee Technical Report, it is clear that more could have been done before 1990, since 1990, and since 1993.

We list below several abatement and mitigation strategies that we believe had the potential to be meaningful, feasible and reasonable. We are not suggesting that the Port had to pursue every

conceivable strategy; we merely note that some additional -- and potentially very effective -- actions were possible.

With respect to noise abatement, for example, the Noise Mediation Agreement could have set a faster Stage 2 phase-out schedule in its alternative process to the complex Noise Budget calculation; if the transition to Stage 3 had been completed in 1995, there would have been, by both the Port's and our estimates, an additional 1.5 dB reduction in DNL (such a faster phase-out, if part of the NMA, would have pre-dated the Aviation Noise and Capacity Act and the Part 161 process). Implementation of minimum population exposure flight tracks could have had an important effect; the Port noted in the February 1996 hearing that its consultant had developed "useful" flight track changes for Four Post Plan noise abatement back in 1990 (as described in the 1991 Noise Mediation Committee Technical Report), and Resolution A-93-03 has called for efforts to reduce the noise impacts of the Four-Post Plan since April 1993. The Port might also have considered adopting a preferential runway plan during "low periods" of activity to reduce population exposure to Airport noise.

In addition, the Noise Mediation Agreement contemplated the following abatement activities which have not yet been achieved (which is, in part, why we found the Port to be in substantial but incomplete compliance with the NMA): enforcement of the North Flow Elliott Bay/Puget Sound nighttime noise abatement departure procedures (which could have been scheduled, pursued, and achieved at any time after these procedures were first implemented); use of the North Flow Elliott Bay/Puget Sound departure procedures or South Flow Arrival Corridor procedures whenever feasible (e.g., during daytime periods of lower activity); and, finally, implementation of controls on engine thrust reversals, to reduce noise in the immediate vicinity of the airport.

On the mitigation side, the single-family residential insulation program could have been accelerated earlier, as we have previously discussed, and the public buildings and multi-family residential insulation programs could have been pursued much more vigorously. In light of the Port's lack of progress on insulation projects after construction of the second runway, we believe it would have been in the Port's best interest to move as decisively as possible in carrying out its commitments under the 1990 Noise Mediation Agreement.

These lists are by no means comprehensive, but they do persuade the majority of the Panel that the Port could have taken at least *some* additional steps to increase the total amount of benefit (in terms of demonstrated, real reductions of noise impacts) in a manner that cumulatively could have shown us enough objective evidence of on-the-ground results to meet the intent of the Resolution. These strategies would have, in different ways, reduced DNL, reduced mean SEL, reduced the Time Above the various levels, decreased speech interference, reduced sleep disturbance, reduced annoyance, and reduced incompatible land uses in the various DNL contour zones.

Accordingly, we conclude that a straightforward interpretation of Resolution A-93-03 does not impose an unrealistic standard of noise reduction on the Port, as Mr. Lewis contends. We do not believe that the amount of noise abatement and mitigation necessary to produce an objectively meaningful or significant reduction in "real noise impacts" within the meaning of Resolution A-93-03 was infeasible, unreachable, or unreasonable.

VII. CONCLUSIONS ON THE EFFECTIVENESS OF THE NOISE ABATEMENT AND MITIGATION PROGRAMS

This Decision represents our best professional judgment, based on many years of experience, many days of public hearings, many months of review and analysis of thousands of pages of data, evidence, and argument, and countless hours of deliberation and debate among the members of the Panel. It was not an easy decision, and it is not a political decision. It is the independent evaluation required by Resolution A-93-03.

How much abatement of aircraft noise is necessary to generate "enough" reduction in on-the-ground noise impacts to satisfy Resolution A-93-03? The ACC, relying on the expert testimony of Dr. Fidell, suggested that a DNL reduction on the order of 4.5 dB -- presumably in conjunction with vigorous action on the mitigation front -- is the minimum needed to produce a meaningful change in noise impacts for the affected population and to support reliable findings of significant benefits in terms of reductions in speech interference, awakenings, and other noise disruption. "To be meaningful," the ACC said in its October 1995 submittal, "a reduction (measured in L_{dn}), must be at least 4.5 dB." Without necessarily endorsing 4.5 dB DNL as a benchmark for determining a meaningful reduction in airport noise, a majority of the Panel has found, after reviewing a very large array of specific evidence at Sea-Tac Airport, that at this Airport, under these particular circumstances, a 3.4 dB DNL reduction over a six-year period has not been sufficient to produce a demonstrated and "meaningful" reduction in real, on-the-ground noise impacts.

We have also carefully reviewed the extensive documentation the Port and other parties provided on the size, nature, and effectiveness of the Port's noise mitigation projects under the Noise Remedy Program. We have found that the Port's mitigation work is effective in producing real indoor (closed-window) noise relief for the residents of insulated homes, but that the scope of the Port's scheduled insulation program remains incomplete with respect to schools, other sensitive-use public buildings, and multi-family dwellings. The Port's mitigation efforts, while substantial, have not yet reached, or been "scheduled" to reach in any concrete sense (i.e., with an explicit timetable and commitment of resources), a large enough portion of the affected population to allow us to conclude that, in combination with the abatement results, the resulting overall reduction in noise impacts has been "enough" to meet the test imposed by Resolution A-93-03.

Accordingly, a majority of the Panel finds:

1. That despite the Port's impressive, good-faith efforts to implement effective noise abatement and mitigation programs, the demonstrated results of the programs it has scheduled, pursued, and achieved since Resolution A-93-03 was adopted (1993-1995 and, alternatively, 1992-1995) do not constitute a "meaningful" reduction of real, on-the-ground noise impacts sufficient to satisfy the noise condition of Resolution A-93-03;
2. That the demonstrated results of the noise abatement and mitigation programs the Port has "scheduled, pursued, and achieved" since 1989/1990 do not provide evidence strong enough to establish, with any degree of confidence, that there has been a "meaningful" reduction of real, on-the-ground noise impacts sufficient to satisfy the noise condition of Resolution A-93-03; and

3. That the Port is not likely to achieve significantly more reduction in real, on-the-ground noise impacts in the near future with the abatement and mitigation measures it has scheduled to date and is currently pursuing.

We reach these conclusions for a number of reasons, including:

(i) the absolute size of the changes in measured DNL (we cannot conclude that the Port has met its affirmative burden under the Resolution on grounds as weak as a maximum DNL change below the threshold of significance);

(ii) our analysis of the meaning of the small average decrease in Time Above 85 dB at the Port's monitoring sites (2-3 minutes per day), the increase in Time Above 85 dB at RMS 11 since 1993, and the current trends in Time Above 65 dB and 75 dB, in terms of real on-the-ground noise impacts;

(iii) our analysis of the corresponding size and direction of the changes in average SEL, nighttime Leq, DNL contours, number and percentage of people "highly annoyed," and other measures discussed above;

(iv) the importance of the factors that are offsetting the improvements the Port has realized to date, such as the increase in the total number of nighttime operations and the unacceptably low rate of compliance with the nighttime noise abatement corridors;

(v) the limited degree of confidence we place in the reliability of the Port's analysis of noise abatement benefits in the absence of needed information on confidence intervals, documentation of INM assumptions and adjustments, and sensitivity analyses, as well as the estimation difficulties inherent in using the available analytic tools to extrapolate significant benefits from very small changes in DNL; and

(vi) the incomplete range of noise mitigation programs the Port has "scheduled, pursued, and achieved" to date, particularly with respect to the sensitive-use public buildings included in the 1990 Noise Mediation Agreement.

On the preponderance of the evidence, we cannot conclude that there has been, as of December 1995, a meaningful or appreciable reduction in the real, on-the-ground noise impacts experienced by a large portion of the population affected by Sea-Tac airport noise, since 1993, since 1992, or since 1989/1990.

There is little doubt that, absent important new initiatives, the Port's current noise abatement efforts will have little additional effect. The steady growth in aircraft operations expected by the Port — which provides the essential justification for constructing the new runway — is already slowing the small DNL improvements the Port has achieved in recent years, and is likely to undermine any additional noise reduction the Port may achieve in the future. In this context, the Port's noise mitigation efforts will become increasingly important; insulation is one area where the Port can readily take additional action. But even a substantially expanded mitigation program can ultimately provide only partial, indoor relief.

Although the Port's ability to substantiate the validity of its estimates of real, on-the-ground noise impacts was weakened by its failure to supply documentation on the statistical reliability of (i) its data, and (ii) its modeling and estimation processes, the Port has nevertheless provided an enormous amount of useful information and analysis. The Port has complied with the Panel's request to provide time-series data on many different aspects of aircraft noise at Sea-Tac, from the basic DNL trends to the distribution of SEL peaks, the minutes per day above 65, 75, and 85 dB, and many other measures. This multifaceted approach to the evaluation of airport noise -- a combination of many different ways of looking at aircraft noise levels and the associated noise impacts on the community -- has been valuable for a number of reasons. It provides a better picture of what is actually happening with Sea-Tac Airport noise levels than DNL alone can convey; it permits the Panel, the PSRC General Assembly, the Port, and the community to assess the actual noise exposure changes and on-the-ground noise impacts more fully; it supplies much-needed detail on critical aspects of those noise impacts (such as the actual amount of time that classrooms are subject to noise levels above the threshold for speech interference); and last but not least, if the results show an internally consistent pattern across a variety of different types of measures (as they, in fact, do in this case), it provides all parties with a considerable degree of added confidence in the robustness of conclusions about the reductions in noise impacts -- the on-the-ground changes in public exposure to Airport noise -- which the Port's current noise abatement and mitigation programs have produced and are likely to produce.

RECOMMENDATIONS (BY THE MAJORITY)

In the course of this proceeding, the Panel has had the benefit of the creative, analytical thinking of many different parties regarding additional noise abatement and mitigation measures that may, alone or taken together, reduce the future noise impacts associated with Sea-Tac Airport. The Port has invited the Panel to offer our recommendations as to what the next steps should be regarding noise abatement and mitigation. The majority of the Panel accepts that invitation.

On the one hand, we do not think that many easy actions remain; the major programs on Stage 2 phase-out and nighttime Stage 2 restrictions are already in place. On the other hand, there are some additional actions that can be implemented relatively quickly and, in some cases, at relatively low cost.

As Mr. Lewis has noted, noise abatement and noise mitigation are not simple. Externalities abound that make an airport proprietor's job difficult. The Port generally gets all the blame (and the credit) for changes in the aircraft noise environment in the Region. The reality is that actions by the FAA, the airlines, local organizations, and State and local political entities all affect the situation. However, while many actions are not within the Port's legal authority, they are not necessarily beyond its range of influence. (Indeed, the Port has been portrayed by many of the people from whom we have heard, and by a number of the submittals that we have read, as a major force in the Region.) That influence should be brought to bear, wherever possible, to reduce on-the-ground noise impacts.

In the spirit of Resolution A-93-03, we offer the following specific recommendations:

1. That the PSRC and the "Coordinating Committee" established by MOU pursuant to Resolution A-93-03 (the PSRC, the Port, WSDOT, and the FAA) promptly take steps to mediate and resolve the impasse between the Highline School District and the Port on the issue of noise insulation for schools, to enable the Port to move forward rapidly on its commitment to insulate the schools and significantly reduce classroom speech interference.
2. That the Port implement its stated plan to upgrade its noise monitoring system, with no fewer than 25 permanent monitoring stations located throughout the affected communities; and that the results be publicly disseminated, at regular intervals, in the form of aircraft DNL, SEL, and Time Above metrics.
3. That the Port and the organizations representing the affected communities jointly sponsor social surveys at regular intervals to assess the effectiveness of future noise abatement and mitigation measures in terms of perceived noise impacts. We concur with the view expressed by the Port's noise consultants in the 1993 AIRTRAC *Final Report* (p. 3-33): "The way to avoid incorrect predictions of community response to a ... [noise reduction] action is to ask the community directly how it feels about a particular airport action and the proposed mitigation program connected to it."
4. That the Port address the impact of ground-related aircraft noise by (i) implementing the thrust-reversal noise impact reduction activities called for in the Noise Mediation Agreement; and (ii) working to minimize the number, level, and duration of daytime engine run-ups, which are likely to increase as operations grow. (We note that the increases in TA 65, 75, and 85 dB at RMS site 11 in recent years may be a consequence of ground-related noise.)
5. That the Port take the following actions to improve the on-the-ground reduction of nighttime noise impacts:
 - a. Negotiate and obtain a public commitment from the FAA for full cooperation in rigorously and aggressively enforcing compliance with the current North Flow Nighttime Departure Noise Abatement Procedures. The Port, at a minimum, should notify airlines of violations of these nighttime noise abatement procedures. Better, the Port should institute procedures to apply pressure, through enforcement penalties and/or the power of public opinion in the media, to reduce violations (for example, publishing fines and performance scorecards in the Region's newspapers).
 - b. Work closely and aggressively with KCIA and Alaska Airlines to eliminate the carrier's two nighttime Stage 2 cargo flight arrivals and departures, which weaken the effectiveness of the Port's nighttime Stage 2 ban; and develop, in conjunction with KCIA and local government officials, a strategy to avoid additional Stage 2 nighttime flights to and from KCIA in the future.
 - c. Work with the airlines to minimize the total number of flights in the middle of the night (e.g., 1:30 a.m. to 5:30 a.m.).

- d. Continue to minimize the number of variances issued for the Nighttime Limitations Program through aggressive persuasion with the airlines, including the use of the media.
 - e. Work with foreign air carriers to ensure that Stage 3 aircraft continue to be used for nighttime international flights.
 - f. Work with owners/operators of Stage 2 aircraft under 75,000 pounds (which are currently exempt from the Nighttime Limitations Program) to secure their cooperation in minimizing or eliminating the use of such aircraft during the nighttime period. (There were, on average, 13 exempt Stage 2 nighttime flights per month in the second and third quarter of 1995.)
 - g. Continue to work with the airlines to minimize nighttime engine run-ups; we note that, although many of the events are exempt from the King County Code, the exempted nighttime events have levels higher than the code permits. Existence of an exemption does not mean elimination of the impacts on people.
6. That the PSRC, the FAA, and the communities affected by airport noise participate actively and constructively in the Port's upcoming Part 150 review, to propose, evaluate, and assist in implementing any feasible noise reduction measures that will maximize the net benefits for the region and provide meaningful noise mitigation for the impacted areas. The Port's Part 150 process should include, but not be limited to, the following actions:
- a. Evaluate the actions needed to apply, monitor and enforce the North Flow Daytime Departure Duwamish/Elliott Bay Noise Abatement Procedures specified in the Noise Mediation Agreement. Investigate, and, if possible, implement, use of this corridor during periods of periods of lighter activity during the day such as mid-morning and mid-afternoon.
 - b. Evaluate the feasibility of extending the "nighttime" hours of use for the North Flow Nighttime Departure Noise Abatement Procedures (currently 10 p.m. to 6 a.m.) to the evening "shoulder" (8 to 10 p.m.), and, if possible, to the early morning "shoulder" (6 to 7 a.m.) as well.
 - c. Reevaluate, with FAA and community input, the use of "minimum population exposure" flight tracks, in light of the increase in flight operations and the shift in the overall importance of arrival noise as Stage 2 aircraft are phased out. The Port had studied and identified "useful" flight track changes for Four Post Plan during the development of the Noise Mediation Agreement. Any of the following options would be expected to reduce overall population exposure to aircraft noise: (i) over-water southern corridors for all south departures where the east turn does not occur until the aircraft reach Commencement Bay or beyond; (ii) north-flow arrival procedures that route aircraft over the water (with a turn in the Four-Post arrival stream); or (iii) the use of a north-flow stream more often at night, coupled with tightly enforced, high-compliance nighttime departure routes. There are some difficult trade-offs in this process, but we do not accept the contention that all possible changes in flight tracks simply shift noise among communities, with no net reduction

in number of people impacted. Flight track changes offer the potential for abatement of aircraft noise impacts once the Port has exhausted the benefits of the Stage 2 phase-out; we note again that Resolution A-93-03 explicitly requested the FAA to consider modifications to the Four Post Plan to reduce noise impacts.

- d. Evaluate, with FAA and community input, the potential net benefits of a noise abatement departure profile employing a steeper angle of climb, coupled with an expanded residential acquisition and insulation program if, as a result of a steeper departure profile, the 75 dB DNL contour expands in the immediate vicinity of the airport while areas farther out receive benefits.
 - e. Evaluate, with FAA and community input, the potential net benefits of preferential runway use during "low activity" periods (would more use of the east runway, for example, result in reduced overall population noise exposure?) -- coupled with an expanded residential insulation and acquisition program, as needed.
7. That, with respect to the Noise Remedy Program, the Port take the following actions:
- a. Begin a rapid, full-scale program of school insulation as soon as the impasse with the Highline School District is resolved, with the maximum feasible commitment of resources and the earliest possible completion schedule.
 - b. Complete the "sensitive-use" public buildings insulation pilot studies and fund the full program envisioned in the Noise Mediation Agreement, as well as a program for insulation of multi-family dwellings, with an aggressive schedule to allow completion as soon as possible. The Port Commission is on record as committed to these programs.
 - c. Evaluate the possibility of an expanded residential acquisition program offering more of the most severely impacted people the buy-out option, even if no additional Federal money is made available for this purpose. While relocation is not desired by all (nor easy for anyone), the environs of a major airport are plainly not the best location for residential neighborhoods.
 - d. Work with the PSRC and the affected communities to design and implement alternative, noise-compatible uses of the land within the current acquisition zone. We note that the acquisition program has some very strong critics because of its adverse effects on the quality of neighborhoods for the remaining houses and businesses.
 - e. Further accelerate, if possible, the rate of insulation for homes now included in the residential noise insulation program, and consider expanding the area eligible for noise insulation if the Airport's 65 dB DNL contour remains at or near the 1993 contour boundaries.
 - f. Investigate possible modifications to the insulation program to mitigate the impacts of low frequency noise and vibration (a concern the public raised repeatedly during the Panel's hearings).

8. That the PSRC and the Coordinating Committee take the lead in addressing the difficult, controversial task of reducing present and future noise impacts, with the following actions:
- a. Recognizing the degree to which parties and factors outside the direct authority of the Port are undercutting the effectiveness of the Port's current efforts to reduce noise impacts, initiate and coordinate remedial action. Such coordination may include facilitating the use of mediation, marshalling State and local public resources where needed, providing public information via the media, or otherwise addressing the roadblocks that now prevent the residents of the Region from realizing the full benefits of the Port's existing abatement and mitigation programs. The PSRC and the Coordinating Committee are the principal entities in a position to take effective action to resolve the local problems caused by the "balkanization" of responsibility among the Port, the FAA, KCLIA, the Highline School District, and other parties.
 - b. Create guidelines or other equitable procedures for dealing fairly with the conflicting views and needs of different communities when a proposed noise reduction strategy results in a net improvement but causes a transfer of noise impacts.
 - c. Take effective action on land use issues to minimize the introduction of incompatible land uses and to facilitate compatible redevelopment of currently incompatible land uses, including implementation of the recommendations on land use issues in the 1993 AIRTRAC *Final Report*.
 - d. Investigate creative ways of linking noise reduction objectives with airport demand and system management strategies, including intermodal solutions to local and regional transportation needs.

DISSENT
(BY MR. LEWIS)

I would find that the Port has met its obligation to show under PSRC Resolution A-93-03 that "noise reduction performance objectives" have been "scheduled, pursued and achieved ... based on measurement of real noise impacts." As a result, I cannot join my colleagues in concluding that the Port has failed to satisfy the noise reduction condition of the Resolution and must dissent from their Decision. I am convinced that my colleagues have imposed upon the Port a burden that was never contemplated by the General Assembly.

The Port showed us that it has scheduled, pursued and achieved the objectives of the two major noise abatement programs contemplated by the Noise Mediation Agreement -- the Noise Budget and the Nighttime Limitations Program -- by significantly reducing the use of the loudest, Stage 2 aircraft at Sea-Tac, and virtually eliminating them at night. The resulting impact on the level of real noise measured on-the-ground has been captured by an extensive array of noise

measurements compiled by the Port that shows a consistent pattern and continuous reduction in DNL since these programs began, associated with the reduction in the loudest aircraft events (which, as the majority concedes, does make a difference in on-the-ground noise impacts). The Port also showed that its residential noise mitigation program has insulated several thousand homes, producing noticeable and meaningful reductions in measured interior noise levels. After carefully considering all of the evidence, it is my judgment that these achievements, confirmed by the measurement of real on-the-ground noise, should be sufficient to satisfy the noise reduction condition of the Resolution.

The majority of the Panel, unfortunately, does not agree. Their determination that the Port has not shown a sufficiently "meaningful" reduction of noise impacts to satisfy the noise condition of the Resolution ultimately depends, as I understand it, upon two essential points: (i) that as to its noise abatement programs, the Port has not established through the use of "established scientific methods" that the reductions in measured noise *levels* it has shown signal a "meaningful" reduction in noise *impacts*; and (ii) that as to its noise mitigation programs, the Port has missed an "opportunity" to provide insulation benefits to thousands of additional residents of the affected community.

I do not believe that the General Assembly required a reduction in measurable on-the-ground noise that would cross an undefined technical threshold of "meaningfulness" so high that doubts about the significance of the resulting reductions in noise impact would be resolved to the satisfaction of the scientific community. The majority places too much emphasis on measurements of noise impacts that could not be made by the Port and were not expected by the General Assembly, and on the failures, rather than the successes, of the Port's insulation program.

It seems unlikely to me that the PSRC would decide not to authorize the third runway simply because: (i) the Port cannot prove through the use of established scientific methods that a measured reduction in DNL of 3.4 dB since the Noise Mediation Agreement was implemented, with continuing reductions since 1993 when the Resolution was enacted, reflects a "meaningful" reduction in noise impacts; (ii) the Port was unable to eliminate the unavoidable uncertainty associated with the extrapolation of noise impacts from incremental changes in measured noise and did not document the assumptions and adjustments it made when using the Integrated Noise Model; (iii) the number of aircraft operations has increased, as the General Assembly assumed it would when it determined that a new runway should "vigorously" be pursued; (iv) significant reductions in the loudest noise events associated with the greatest interference with speech and disturbance with sleep have, in recent years, been offset to some extent by increases at lower sound levels that inevitably accompanied the recent, expected growth in the number of aircraft operations; and (v) the Port's noise mitigation programs have not yet reached their full potential. Yet this appears to me to be why the majority has ruled against the Port. In my judgment, based upon all the evidence, there has been a sufficient reduction in real, on-the-ground noise impacts to satisfy the requirements of the Resolution.

In recognition of increasing capacity problems at the Airport, the General Assembly declared in the Resolution that "the region should pursue vigorously ... a third runway at Sea-Tac" and determined that, under present circumstances, the third runway shall be authorized by April 1, 1996 "[w]hen noise reduction performance objectives are scheduled, pursued and achieved based on independent evaluation, and based on measurement of real noise impacts."

The Resolution was adopted by the PSRC three years after the Port implemented the Noise Mediation Agreement. The Agreement was, as the majority observes, an "important milestone" in the reduction of adverse environmental impacts from airport operations. It scheduled three bold initiatives: the Noise Budget, the Nighttime Limitations Program and the Noise Remedy Program. Unfortunately, the precipitous conclusion of the noise mediation, the disturbing introduction of the Four Post Plan, and lingering doubts about the motives of the Port left many in the community unconvinced that the Port would meet its commitments, that these programs would make any difference, and that the Port's sophisticated computer models had anything to do with the real "on-the-ground" noise they perceived. The General Assembly therefore called for an "independent evaluation" of whether the Port had scheduled, pursued and achieved "noise reduction performance objectives ... based on measurement of real noise impacts." The enactment of Resolution A-93-03 manifested the General Assembly's apparent desire for independent, objective answers to several basic questions:

- Did these programs establish significant noise reduction objectives?
- Has the Port done what it said it would do to reduce on-the-ground noise?
- Do actual measurements of on-the-ground noise confirm that the noise reduction objectives of the Port's programs are being achieved?

I believe the correct answer to all of these questions is "yes."

The Port's Noise Budget and Nighttime Limitations Program established ambitious noise and access restrictions under the Noise Mediation Agreement that were, as the majority acknowledges, most likely to produce significant benefits because they addressed airport noise at the *source*: the use of loud Stage 2 aircraft, especially at night. These restrictions were far more stringent than the national rules established by Congress when it later enacted the Airport Noise and Capacity Act of 1990, requiring a phase-out of Stage 2 aircraft. In fact, if the Noise Mediation Agreement had not been negotiated before November 1990, and therefore exempted from the Act, the Port would have been unable to reduce or limit Stage 2 aircraft operations as it has under its noise abatement programs.

All of the members of the Panel have found that the Port is in substantial (if incomplete) compliance with the Noise Mediation Agreement, and that the scheduled noise reduction objectives of the Noise Budget and Nighttime Limitations Program have been pursued and have achieved a reduction in measured "on-the-ground" noise captured by DNL at the Port's permanent monitoring sites both since the Agreement was made in 1990 and since the Resolution was enacted in 1993.

In our January 9, 1995 Noise Order, however, the Panel determined that the Resolution required the Port to show more than just compliance with the Noise Mediation Agreement and a resulting measurable reduction in noise *levels*; the Port, we felt, had to show a "meaningful" or "significant" reduction in noise *impacts* on the community. In retrospect, it seems to me that the Panel may have been mistaken. The subsequent hearings, our protracted deliberations and the split on this Final Decision all reflect the difficulty of determining *how* the "meaningfulness" of noise reductions should be assessed for the purposes of the Resolution.

When we issued our Order in January 1995, the Panel reasoned that the General Assembly did not need to obtain an "independent evaluation" by a panel of outside experts if the only question was whether *any* reduction in noise impacts evidenced by actual on-the-ground sound measurements had been "scheduled, pursued and achieved" by the Port, and so we held that the reduction in noise impacts had to be "meaningful." At the same time, however, we explained that the Resolution did not impose upon the Port a standard of performance that it could not possibly meet. The General Assembly, after all, had voted to pursue construction of the third runway "vigorously" if the stated conditions were satisfied, and it would have made little sense to impose an "unreachable" or "infeasible" condition in those circumstances. I thought that our consideration of the Noise Issues required the Panel to assess the significance of the reductions in noise impacts scheduled, pursued and achieved by the Port given what it was reasonable to expect (from the General Assembly's perspective) that the Port could do to reduce the impact of airport-generated noise on the surrounding community by the time the third runway was to be authorized by the PSRC.

The "meaningfulness" and "reasonableness" standards we imported to the Resolution do not provide a definitive benchmark or prescribe the use of established scientific methods to assess the adequacy of the reductions in noise impacts achieved by the Port. We acknowledged in our December 1995 Preliminary Order on Phase II Noise Issues, in fact, that the Resolution called upon the Panel to use our "best professional judgment ... to determine whether, taken as a whole, the pattern of change in noise impacts is sufficient ... to meet the requirements of the Resolution." In my view, the Panel's assessment should reflect both "the best insights we can gain from established scientific sources about the significance of changes in various noise metrics as indicators of changes in the impact of noise on the people in the communities surrounding the Airport," and our knowledge and experience in dealing with the institutional, operational, and regulatory constraints that limit an airport owner's ability to reduce the noise impacts of a busy, growing jet airport. Based upon these considerations, I am confident that the pattern of change in measured real on-the-ground noise levels shown by the Port is sufficient to show a reduction in noise impacts that satisfies the requirements of the Resolution.

Noise Abatement. The Port showed that its noise abatement programs have produced reductions in on-the-ground noise measured by a variety of different metrics that are related to adverse impacts for many people throughout the region.

The Port stressed the reduction in aircraft DNL over the years because the relationship between DNL and human "annoyance" is well accepted in the airport industry and the scientific world as the best aggregate indicator of adverse noise impacts. As the majority puts it, "[a]ircraft and total DNL metrics are the principal tools used to summarize the overall changes in environmental sound levels associated with airport operations." Measured aircraft DNL around the Airport has fallen by 2.8 dB since 1986, 3.4 dB since 1989/1990, 2.3 dB since 1992 and 0.9 dB since 1993. These reductions can be expected to be related to significant reductions in the numbers of people "highly annoyed" by aircraft noise, on an aggregate basis, even if the difference in sound levels, occurring over time, might not be distinguished by an individual observer.

The Port supplemented its analysis of DNL with a review of on-the-ground measurements using the TA and SEL metrics that confirm that there has been, as expected, a significant reduction in the highest-noise-level aircraft events. While the relationship between these metrics and adverse noise "impacts" is less well understood, the Port has shown that reductions in the loudest events,

which are segregated by these metrics, can be expected to be related to reductions in both "high level" speech interference and, possibly, sleep disturbance.

The majority of the Panel has nevertheless concluded that the Port's noise abatement efforts have not produced a sufficient reduction in real, on-the-ground noise impacts to satisfy the requirements of the Resolution. While I greatly respect their thorough review and technical analysis, I do not believe that the General Assembly intended us to apply a standard so exacting as they have used and, therefore, I cannot accept their ultimate assessment of the significance of the noise reductions the Port has shown.

The reliability of the Port's technique of imputing estimates of the population exposed to different sound environments over time, and the methods it used to convert incremental changes in noise exposure into estimates of reduced annoyance, speech interference and sleep disturbance, are subject to serious reservations. But when it called in the Resolution for "measurement of real noise impacts," the General Assembly did not require, and could not reasonably have expected, rigorous scientific proof that incremental, measured improvements in on-the-ground noise levels can be related to particular reductions in noise "impacts" that could be said by some objective measure to be "meaningful."

Based upon the evidence offered to us, I would find that the "established scientific methods" for assessing the impact of aircraft noise are not designed to provide precise estimates of the significance of incremental changes in noise exposure over time and do not establish a definitive DNL threshold for measuring meaningful aircraft noise reductions.

The majority of the Panel has nevertheless found that the 3.4 dB reduction in aircraft DNL shown by the Port is "below the threshold of 'meaningfulness' in terms of producing a real, appreciable reduction in airport noise impacts for an affected population," especially when that DNL change occurs over a period of six years and is coupled with an increase in operations. The majority concluded, therefore, that the Port's noise abatement efforts have not produced a sufficient reduction in real, on-the-ground noise impacts to satisfy the noise condition of Resolution A-93-03.

This approach imposes an "unrealistic standard of noise reduction" on the Port. When the Resolution was enacted, it was to be expected by the General Assembly that (i) any reductions in noise levels would occur incrementally over a period of many years; (ii) that at the same time, aircraft operations would increase; and (iii) that, as the majority recognizes, analytic tools like the FICON Curve "cannot provide robust estimates of the population impacts of the small reductions in DNL" that could be expected to be realized by the Port's noise abatement programs. Under these circumstances, it is unreasonable to impute to the General Assembly an expectation that the Port should show a reduction in noise levels, measured by DNL or otherwise, so significant that it would resolve scientific doubts about its meaningfulness, before the third runway would be authorized. Accordingly, I cannot accept my colleagues' conclusion that the Port's noise abatement programs have not achieved a meaningful reduction in noise impacts.

Noise Mitigation. I must also distance myself from their assessment of the Port's insulation program. As they acknowledge, the Port has done an "impressive job" on its residential noise mitigation programs since the Resolution was enacted and has provided appreciable benefits to thousands of residents of the Region. The Port has already insulated 3,647 homes and is continuing

its accelerated program of insulating about 110 homes each month. There is no dispute that this program provides noticeable and meaningful indoor noise reductions.

While the majority applauds the success of the Port's noise mitigation program, it focuses on the Port's failure to accelerate the pace of the residential insulation program *before* the Resolution was enacted and to implement a comprehensive program for the insulation of public buildings. I share their concern, especially about the public schools, but for me the determinative facts are (i) that thousands of residents have benefitted from residential insulation; (ii) that since 1993, when the Resolution was enacted, the pace of the Port's residential insulation program has accelerated to an "exceptional" rate, as the majority puts it, that is almost four times faster than the rate contemplated under the Noise Mediation Agreement; (iii) that in recent years the number of sensitive-use public facilities (schools, hospitals, churches, and libraries) within the loudest noise contours has been markedly reduced; and (iv) that the Port's failure to insulate the many primary and secondary schools in the Highline School District cannot properly be charged to the Port's account in this proceeding, because the Port has agreed for some time to fund the insulation of these schools and its offer has been refused.

The Port's noise mitigation program has provided significant benefits to thousands of residents of the neighborhoods most adversely affected by airport noise and has contributed to, not detracted from, the achievement of a meaningful reduction in noise impacts.

Reasonableness. The significance of the noise reductions scheduled, pursued and achieved by the Port has properly been the focus of the Panel's hearings, its deliberations and this Final Decision. But as the Panel previously interpreted it, the Resolution has both a "meaningfulness" requirement and a "reasonableness" constraint. I believe that the General Assembly did not intend to give up its plan "vigorously" to pursue the runway, even if the Port's noise reduction was not sufficiently "meaningful" to satisfy a majority of this Panel, unless there was clear and convincing evidence that the Port could reasonably have been expected to have been able to schedule, pursue and achieve a *significantly* more meaningful reduction in noise impacts than it has shown.

The community advocates (and at various times, each of the members of the Panel) have raised questions about noise abatement and mitigation measures that have *not* been scheduled, pursued or achieved. But the opponents of the runway have not met their threshold burden to show that in spite of whatever legal, operational and practical constraints it faced, the Port could have undertaken additional noise abatement or mitigation programs that could reasonably have been expected to produce a material change in noise impacts during the pertinent time frame (that is, they would have made an otherwise insignificant reduction meaningful), given the approach to assessing "meaningfulness" adopted by the majority.

While a rigorous analysis of the impact of potential alternative noise measures would have been desirable, the evidence presented to the Panel does not show that the Port squandered opportunities to "schedule, pursue or achieve" *significantly* more meaningful reductions in noise impacts after the Resolution was enacted in 1993 and, in the words of the majority, "served notice to the Port that it would ... have to show that its noise programs were, in fact, producing results in the form of meaningful, measurable, on-the-ground reductions in noise impacts."

I take little comfort from the majority's speculation that the 5 dB reduction in DNL they imply would be necessary to satisfy the Resolution "might very well be achievable." The Port has

scheduled, pursued and achieved the objectives of the noise abatement programs that have been most likely to produce a meaningful reduction in noise impacts. While the Port can, and should, continue to find creative ways to reduce the burden of aircraft noise on its neighbors, there was no evidence before the Panel that the Port could have caused a significantly greater reduction in DNL without imposing artificial capacity constraints at the Airport that would be inconsistent with Federal policy and with the core objective of the PSRC Resolution: the *expansion* of regional airport capacity.

Conclusion. I doubt that the General Assembly contemplated that its decision to authorize the third runway under the Resolution would depend upon the success of the Port's unprecedented efforts to use established scientific methods to convince a panel of experts exactly how the impacts of measured reductions in on-the-ground noise can be expected to benefit the community. Ultimately, the Panel had to resolve what both Dr. von Gierke (an expert for the Port) and Dr. Fidell (for the ACC) recognize is a social, economic, or political question, not a search for an elusive, "scientifically accurate" judgment, about whether the noise reductions shown by the Port were sufficiently "meaningful" to satisfy the Resolution. I am convinced that given the achievement of the objectives of the Port's noise abatement programs; the reductions in measured on-the-ground noise shown by the Port that resulted from the accelerated reduction in Stage 2 operations, especially at night; and the insulation of thousands of homes, the Port has met its burden.

The Panel's focus has been on what the Port has done in the *past* to meet its obligation to reduce the impacts of aircraft noise on the community. While members of the Panel ultimately reached different conclusions about the Port's success, we all recognize that in the *future*, the need to find new ways effectively to reduce aircraft noise impacts will intensify as the number of aircraft operations at Sea-Tac continues to grow, with or without the new runway.

The Port was able, in my judgment, to achieve a significant reduction in noise impacts in the past by reducing noise levels at their source: the aircraft that use the airport. In the future, that approach is unlikely to be effective. The Port has little, if any, ability to control the noisiness of aircraft, the number of operations, or the flight tracks they use. The Port and the community must seek creative approaches to noise reduction that take new forms, even if they are more controversial than reductions in aircraft noise that come at the expense of commercial airlines.

The members of the "Coordinating Committee" -- the PSRC itself, the Port, the FAA and the WSDOT -- have, it seems to me, both an obligation and an opportunity to work together to achieve future reductions in noise impacts that have not been realized in the past. I am confident that I speak for the entire Panel in urging the Coordinating Committee to overcome the institutional barriers between the Port and local government that have prevented the Port from mitigating *learning* interference by insulating public schools in the Highline School District; between the Port and County government that have allowed Alaska Airlines to avoid the Nighttime Limitations Program and insult the community by moving flights to Boeing Field; and between the Port and the FAA, which has been unduly resistant to changes in flight procedures that could reduce noise impacts. The Coordinating Committee can, and should, play an important role in minimizing the adverse environmental impacts of any necessary expansions of the Region's airfield capacity.

**CLOSING REMARKS
(BY THE PANEL)**

We have not been asked to consider, and we have expressed no views about, whether the proposed third runway should be built, about the value of the capacity enhancement it would bring or about its environmental impact. We have not considered, and do not offer any opinion about, whether the adverse environmental impacts associated with a major runway expansion project can be fully mitigated.

Our findings and conclusions are based upon a unique set of facts, at the existing Airport, that were presented to us under an unusual local resolution. While we hope that the PSRC, the Port, the FAA, and the affected communities will benefit from our work, our analyses here do not necessarily provide a precedent for the resolution of noise issues at other airports. Whether resort to an expert "arbitration" panel is, in general, a productive approach to help resolve these issues remains to be seen.

The process has generated an exceptionally detailed and thorough public record of data and analysis with respect to past and present noise levels, noise impacts, and the effectiveness of noise reduction measures at a major airport. We commend and thank all of the participants for their considerable contributions to this proceeding; the extent and analytical depth of the evidence presented to this Panel reflected an extraordinary commitment of effort and resources by many different parties. We also wish to acknowledge the outstanding logistical support work provided by the staff of the PSRC, particularly Mr. Jerry Dinndorf and Ms. Clare Impett, throughout this proceeding.

There is nothing simple or easy about the Port's effort to improve Airport capacity while reducing public exposure to Airport noise, or about the public's effort to maintain livable communities and improve the quality of life for which this Region is rightfully known. Airport noise is a tough problem. We deeply appreciate the trust that the PSRC General Assembly and the parties to this proceeding have placed in our ability to reach a careful and impartial judgment, and we have each given our best effort to the task of making that judgment. We are grateful to have had the opportunity to serve the Puget Sound Region.

For the Majority:

William Bowlby
William Bowlby *mcl*

Martha J. Langelan
Martha J. Langelan

For the Dissent:

Scott P. Lewis
Scott P. Lewis, Chair *mcl*