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NOAA SCIENCE PANEL II

PUBLIC FORUM ON

SFO TECHNICAL REPORT

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WEDNESDAY, JUNE 25, 2003

9:00 a.m. - 12:00 p.m.

Herbst Theatre, War Memorial and

Performing Arts Center

401 Van Ness Ave., San Francisco, CA

FRIDAY, JUNE 25, 2003 9:00 A.M.

P R O C E E D I N G S

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MR. McKINNIE: Good morning. Why don't we get started. -- worked with Jerry Schubel as closely as I have over the past two and a half years probably do not realize that Dr. Schubel always starts on time regardless who is here and whether they are standing or sitting. Good morning. My name is David McKinnie. I am with the National Oceanic and Atmospheric Administration, shorthand is NOAA. I am very pleased to welcome you to the last meeting of the Independent Scientific Peer Review Panel on Runway Reconfiguration at San Francisco International Airport. I will not try to give you the acronym.

Over the past two years, the Science Panel has reviewed thousands of pages of material and met more times as a Panel than the Panelists can remember to conduct this independent review. The process is not always easy and it is not always friendly, as Mike Sling (phon) will attest. Most of our work is done outside the public eye and it is a pleasure to invite you to join us for this meeting. After this forum, the Panel will publish a final written report that will include all of its comments on the various drafts of the studies and its assessment of the final reports the FAA and its consultants have prepared. Before we move on to the main business, a word about how the Panel was formed would be appropriate. You may recall that in 1999, the Bay Conservation and Development Commission and the other Bay Regulatory agencies, both state and federal, requested that NOAA convene an independent science panel to help identify environmental issues that needed to be addressed as SFO moved forward with plans to build new runways in the Bay. The Panel, often called Science Panel I, did so and made a series of recommendations, including a recommendation for an independent peer review of any environmental studies commissioned for the Airport project. In late 2000, as these studies were already getting underway, BCDC, again joined by the other regulatory agencies, and this time joined by SFO, the City of San Francisco, and the FAA, again asked NOAA to convene and facilitate a Science Panel, this time to implement the first Panel's recommendation for independent peer review. This effort, often called Science Panel II, culminates with this forum and the publication of our final report later this summer. It is important to note that the Panel did not review all of the studies that were in preparation to support the Environmental Impact Statement and the Environmental Impact Review. We only reviewed a subset. In particular, we looked at the studies on hydrology, sedimentation, water quality and contaminants, and biological resources. As I think the consultants will tell you, there are many many others that were in preparation to support the environmental documents. It is also critical to note that the Panel's charge was to conduct a scientific peer review of these studies, it was not to offer opinions about whether the impacts these studies predict are acceptable, or whether or not the runway should be built. That is for the public to decide through the regulatory and public policy process. Before I introduce the panel members, I need to add the obligatory disclaimer on behalf of NOAA. The views expressed by the Panel at this hearing in the final report are those of the Panel and not, of course, necessarily of NOAA or the agencies the different Panelists may work for. With that, I am pleased to introduce the Panel to you, starting with Dr. Jerry Schubel, the Chair, who is currently President and CEO of the Aquarium of the Pacific in Long Beach. He invites you to come visit that Aquarium as soon as possible. Formerly, he was President and CEO of the New England Aquarium in

Boston where he is now President Emeritus, and before that Dean of Marine Sciences and Provost at the State University of New York's Stony Brook. And this is not the first, nor will it be the last of these kinds of independent peer reviews Dr. Schubel has facilitated. And I will just list off the Panelists in alphabetical order. Not all Panelists could be here, unfortunately. I will identify the ones who are not here. Sarah Allen, a marine mammal expert, is unfortunately not here; John Calloway is a Wetlands Ecologist; Jim Cloern, who is an Ecologist, is not here; Russ Flegal, a Water Quality expert, an Ecotoxicology Expert; Dr. Jerry Galt, a hydrologist and modeler, Janet Hanson is our bird expert; Ted Hobson is one of our fish experts; Henry Karl (phon), who looks at sediments and also public process in science is not here, unfortunately; Diane Kopec, a marine mammal expert; Ed Long who does sediment toxicity, Fred Nichols, a benthos expert -- and he will actually explain what the benthos is for those of you that may not know; Jerry Orlaub (phon), who is not here, is a Hydrologist; Tom Powell, who does Biology, is also unfortunately not here. David Schoellhamer, who does sedimentation and hydrology; John Stephens, again, fisheries; and Bruce Thompson who does water quality is unfortunately not here. I also would like to take a brief moment to recognize Commander Steve Thompson, who is the NOAA site representative here in San Francisco Bay, and Tom Richards and Jennie Johnson of my staff who have made all this possible, along with Commander Thompson. I look forward to an interesting and informative forum. Dr. Schubel.

DR. SCHUBEL: Thank you and good morning, everyone. I expect that, as the day goes on, we will see more people coming in. We are nearing the end of the involvement of this NOAA Independent Peer Review Panel II and today, for the next several hours, it will unfold. You need to know that this is the Science Panel's meeting and no one else's. Our goal for today is to have a clear overview of the panel process, how we have been involved and in what ways for the last several years, to provide the opportunity for you to hear a description of the proposed runway reconfiguration alternatives by the FAA, to let you have brief summaries of what URF has found concerning the environmental effects of any proposed runway reconfiguration, and then we will give you an overview of our assessment, that is, the panel's assessment of the scientific quality of this study, particularly in terms of how it addressed a number of questions -- did they ask the right scientific questions about the proposed runway reconfiguration in terms of any environmental impacts on San Francisco Bay? So, did they ask the right questions? Were the scientific and technical studies designed and conducted properly to address these questions? Are the conclusions of the consultants supported by the data collected, the information generated? And are those findings scientifically defensible? What level of uncertainty is inherent in the projected environmental impacts of the proposed runway reconfiguration given the scope of the tasks and the limitations of science? And, finally, what additional studies would be required to appropriately evaluate the environmental impacts of the proposed project, both during construction and subsequent to construction? And we also want today to give you the opportunity to ask questions of the panel or of URS.

We have a lot of ground to cover and if we are going to do it, we are going to have to stay on schedule and so let me make a few comments. This is a public meeting, but not a public hearing. There will be lots of public hearings. Because it is a public meeting, we are not going to take any statements, but we encourage you to write your questions on the cards that have been made available. Those will be passed up to the front and, given the time that we have available, we will try to get to as many of those as we possibly can. And I think I want to underscore what David McKinney has already said -- what our roles were and were not -- and I am speaking now for the panel, not just for Jerry Schubel. Our roles were that it was our responsibility to oversee the scientific studies to ensure that, again, the appropriate questions were asked and the appropriate strategies were used, and it was not our responsibility to actually do any of the science, number 1, nor is it our responsibility to assess whether the forecasted effects of any of the proposed runway reconfigurations are acceptable. Acceptability is not a scientific question, it is a societal question. And the goal in all of this was to remove the necessity for having to have a lot of discussion in the public process as to whether the science was any good so that society can concentrate on other aspects of this decision.

Let us now have a brief summary of the runway alternatives and Camille Garibaldi of the FAA will give that description.

MS. GARIBALDI: Good morning. As Dr. Schubel mentioned, my name is Camille Garibaldi and I am the Project Manager for the Federal Aviation Administration's Environmental Impact Statement. On behalf of the FAA, we would like to thank Dr. Schubel, David McKinney, and the panelists for their continued efforts in this intensive peer review process. We would also like to acknowledge NOAA's efforts to maintain the Peer Review Panel. For clarification sake, I would like to point out that the Hydrodynamic Sediment Transport Water Quality and Biological Resources Technical Report is not the Environmental Impact Statement that would contain the Agency's determination of impact significance for the runway reconfiguration project. It is a technical report that the FAA would consider along with other resource evaluations such as air quality and noise that would be completed if the agency were proceeding with its Environmental Impact Statement. However, since the City and County of San Francisco has decided to suspend its Runway Reconfiguration Project, the FAA has stopped preparation of its Environmental Impact Statement. Although this is not the EIS, we are pleased to make this final report publicly available since we believe it to be the most up-to-date compilation of Bay ecology data now available. The FAA would like to acknowledge and thank the entire project team for their dedicated efforts and expertise to conduct the analyses and preparation of this report. I am going to have the URS project team do a brief technical presentation, and I would like to introduce Mr. Tom Bailey, who will begin the presentation and discuss the alternatives considered.

MR. BAILEY: Thank you very much, Camille. Our presentation today, we would like to start with just a little overview of the existing air field, describe the project alternatives considered in the technical report, touch upon the questions that were posed for our investigations and the studies that we use to try and answer those questions, and then we are going to spend most of our time talking about the results of those various investigations. Before I begin the presentation, though, I would like to give you just a brief definition about areas of the Bay that we use in the technical report and will use in the presentation today. When we refer to the South Bay, we mean the entire Bay, roughly south of the Oakland Bay Bridge. The lower South Bay is that portion of the South Bay below the Dunbarton Bridge. The Central Bay lies roughly between the Oakland Bay Bridge and the Richmond San Rafael Bridge, and the North Bay is above the Richmond San Rafael Bridge. I would also like to point out that our evaluations of changes resulting from project alternatives did not consider any mitigation measures. Mitigation measures would be identified during the development of an EIR or an EIS and, as Camille has indicated, that work has been terminated. The existing SFO air field consists of two pairs of parallel runways that intersect at mid field. The 119 runways are this pair, and the 1028 runways are this pair. Air field was designed in the 1940's and each pair of runways are separated by 750 feet, center line to center line. Now the FAA and SFO have considered a variety of alternatives to improve the operational efficiency of the Air Field to address existing poor weather delay problems and projected future air travel demand. This technical report looks at those alternatives that would re-configure the runways and result in the construction of new runways, runway extensions, and runway safety areas in the Bay. Alternative A-3 here would construct a new 1028 runway in the Bay and have a taxiway connecting that new runway to the existing air field. It would also construct what are called runway safety areas at the end of the existing 119 and 1028 platforms. Alternatives BX-6 and BX Refined, or BX-R, would also have this new 1028 runway and would separate the 119 runways, with alternative BX-R, one of the 119's extending further into the Bay than on Alternative BX-6. In all three of these alternatives, the new 1028 runway could be built either on fill or on pilings. The other runways, runway extensions and safety areas, would have to be built on fill to avoid interfering with Air Field operations during construction. Therefore, our technical report looked at a total of six reconfiguration alternatives, these three reconfigurations built either all on fill or a combination of fill and piles, termed the "Hybrid Alternatives."

Now, several alternatives sources of fill for the project were considered. The Technical Report only evaluates one of those, which is located in the Bay. That is about two to three miles offshore of Bay Farm Island and it is termed East Bay Shoals. Fill from that site could be dredged hydraulically and transported down to the SFO construction site by a temporary pipeline placed on the bottom of the Bay. Now fill is brought from outside the Bay. It would come in by ship or hopper dredge. And it may be necessary to stockpile that material in the Bay at what is called a re-handling basin, and then it would be picked up by hydrolic dredge and transported by a pipeline to the construction site. Now if the fill were to come from outside of the Bay in combination with using the East Bay Shoals Borrow Site, then that re-handling basin would probably be located at the East Bay Shoals. If all the fill for the project were to come from outside the Bay, the rehandling basin would probably be located here at San Bruno Shoals. Construction of the project -- first of all, to reach that sand fill, young Bay mud would have to be removed from the East Bay Shoals Borrow Site. In addition, some young Bay mud would have need to be dredged from the SFO construction site. Several alternatives were considered for the re-use and disposal of that young Bay mud. There could be upland re-use in the North Bay or the South Bay. It could be disposed of at the San Francisco Deep Ocean Disposal Site, or it could go back into the East Bay Shoals Borrow Site once the fill has been removed. This slide shows the volumes in millions of cubic yards of both fill and young Bay mud that would be dredged. This roughly ranges for Alternative A-3 hybrid from about 8 million cubic yards up to almost 70 million cubic yards for alternative BX-R fill. This slide shows the areas of the Bay that could be affected by the various alternatives. This column gives you the platform area for the reconfigured runways basically at the water surface. This is their footprint. Construction at the site would require dredging of temporary access channels to bring construction equipment into SFO. These are the acreage that would be affected, and the East Bay Shoals borrow site footprint. These acreage range from about 360 acres for alternative A-3 hybrid, up to a little over 2,100 acres for Alternative BX-R fill. With that introduction on the project, I would like to turn it over to Bill Fehring.

MR. FEHRING: Thank you, Tom, and good morning. Each scientist studying the Bay in some way uses a conceptual model to understand and explain how the various physical, chemical and biological components interact. The NOAA Panel has asked the EIS team to identify the conceptual model that it used in developing the studies of potential changes that would be associated with such a runway reconfiguration. The model we used includes the following features: first, there is a series of physical drivers which include chemical constituents in the sediments and water, hydrodynamic factors such as tides, circulation and waves, the structure and bathimetry of the Bay, sediment bed properties, and other physical conditions such as noise and vibration that occur naturally or occur in the Bay at the existing time. Second, there is a series of biological drivers on this line here that respond to physical drivers that are controlled by them, and these include water quality, sediment transport, including erosion and deposition and re-suspension, habitat, things such as shallow water areas and mudflats, sediment quality, and other conditions such as changes in noise levels or human disturbance over here on the right side. Finally in this model, there is a set of biological communities, and it is replicated on both sides, that respond to these biological drivers. These include benthic and intertidal communities of fish and vertebrates, pelagic communities of fish and plankton, aquatic birds, and marine mammals. In this model, a runway reconfiguration would alter one or more of the physical drivers or the relationship between the physical drivers and the biological drivers, and this in turn may affect the biological communities. The model also recognizes that there are many external factors that would not be affected by a runway reconfiguration in these boxes at the top and bottom. These include physical factors such as sunlight, freshwater inflows, nutrient inputs, and changes in sea level. They also include biological factors such as regional population dynamics, regional long-term habitat succession, and changes in conditions at breeding areas remote from the Bay. Such external factors contribute to uncertainty in making predictions based on this model, along with the uncertainties inherent to any predictive modeling efforts.

I would now like to use this model to illustrate just two of the many questions that were posed by the NOAA

Panels I and II that were identified during the scoping process, or developed by the study team to illustrate how the model works. The first question is how would changes in water flow patterns resulting from the runway reconfiguration that alter existing deposition and erosion patterns and existing shallow water habitats. In this instance, the dredging, the changes in bottom elevations due to fill or dredging operations, would alter the relationship between the structure of the Bay and the hydrodynamics. This in turn would alter sediment transport and that in turn would alter habitat itself. Also, any change in bottom elevations in addition to changing the hydrodynamics may directly affect the existence of certain habitats. The second question is how would dredging and construction affect the mobilization of legacy sediment contaminants and the levels of those contaminants in animal species in the Bay. In this instance, the re-suspension of material during the dredging operation would affect the availability of sediment contaminants in the water column and over in the surficial sediments. Changes in the levels of those contaminants would affect tissue levels in both benthic and pelagic fish species, which may in turn affect the levels of those contaminants in birds and mammals.

To study such questions as these, a team of scientists was assembled. This slot identifies the team assembled to address the topics of hydrology, sediment transport, and water quality. The team included representatives of URS, the Danish Hydrolic Institute, the Woods Hole Group, and a number of individual consultants as shown. The team assembled to identify potential changes to biological communities included scientists from URS, San Francisco State University, San Jose State University, ABA Consultants and, again, a number of individual consultants. A series of studies were undertaken to supplement the existing scientific data regarding the areas likely to be affected by the construction and operation of a runway reconfiguration. The following slide show the locations of where data was collected regarding tides, currents, and suspended solids, conductivity in temperature, sediment and poor water quality, benthic communities, eelgrass, fish populations, shorebirds, least terns, water fowl, and harvest seal haul-out sites. When combined together, these studies have provided the team with a broad coverage of the entire South Bay. Our approach to the studies of the physical and chemical environment used existing scientific data supplemented by a project specific data collection as input to predictive computer models, including the MIKE 21 series of models developed by the Danish Hydrolic Institute, the TRIM 2D and 3D models, and the U.S. Army Corps of Engineers ADDAMS series of models for dredging effects on water quality and sediments. Our studies of the biological environment included the following approaches -- direct toxicity to aquatic organisms were studied based on published dose responses and the results of the water quality modeling. A food web model was used to estimate toxic effects to upper trophic level receptors. Physical biological predictive models were used to project phytoplankton and photosynthetic rate and biomass. And, finally, physical and chemical modeling results were combined with existing scientific data and professional experience to estimate effects on mackerel invertebrates, fish birds, and marine mammals. I would now like to turn the presentation over to Lou Armstrong to discuss the results of the hydrodynamic studies.

MR. ARMSTRONG: Thank you, Bill. I am going to talk today a little bit about the hydrodynamic and sedimentation sections of the report. We did a variety of things in the report, but I am going to highlight a few things today, including circulation patterns, long term sedimentation, and suspended sediments associated with construction. And a lof of this, we looked at changes associated with these things, as well as the sensitivity that went along with those changes. As far as looking at circulation patterns, what we have here is the no-project alternative and the Alternative BX-6 here. Just to give you a little bit of feel, this here is about 5 kilometers, this here is about 2 kilometers, the arrows that you see up there, the size and darkness, indicates speed. I only cut out a small piece of the model. We actually did model the whole Bay from the North Bay all the way down to the South Bay, but that would be very difficult to see, so I have just cut out a piece of it here.

Things I like to point out is, essentially we see that these darker areas here in the middle of the Bay are the channel, the life line of the Bay which pumps water back and forth with the tides. Over here near the existing runway, we see some circulation patterns and a little bit of change here, and over here we see that, in fact, the circulation patterns -- we see some bending of the currents here and here, which is the change in the similar circulation patterns.

Now I would like to talk a little bit about changes in habitat type over a 50-year period, so long term. Again, on this side we have the No project, and on this side, the BX-6 alternative. And in the colors that you are seeing here, the yellow is mudflat, the orangey color is shallow bay, which is defined as from the mudflat to the 6-meter, and that is defined by the Goals Report. The green area is deep bay, which is greater than 6 meters, and the blue are the channel, which is also considered deep Bay. I am going to run the movie on the No Project side first. This is again over 50 years and what we see is that the mudflat behind the existing runways here is increased. We have seen some decrease in the deep bay and some increase in the shallow areas. Now I am going to run BX-6. What we see is similar patterns here in the deep and shallow bay. What we also see though is that the mudflat here did not grow as much. And the reason for that is, if you remember these circulations patterns, as the currents come back here, they start to drop their sediment. And when they drop their sediment here, although they are increasing the sedimentation in that area, we are not changing the habitat type as defined by the mudflat to the 6 meters. We also see some increased erosion here at the tips, which changes it from shallow bay to deep bay.

Lastly, I would like to touch on changes in suspended sediment during construction. In this case, what we are looking at is the worst case. There are two dredges over by the existing air field, and four dredges out here in the Bay, two of which are actually dredging material up, and two of which are actually placing material. Now what we are going to see here is an instantaneous movie, instantaneous meaning what would be seen at that time somewhere in the water column, not necessarily seen at the surface. And what we are looking at here is change, as it is in suspended sediment, in milligrams per liter ranging from this kind of yellow/brown color at 10 mg per liter up to red which is about 45. I should point out that given this range -- while you watch this -- that the range in the Bay varies from about 10 to 300 mg per liter, depending on the wind conditions during the day. So here we are seeing the changes.

And with that, I would like to turn it over to Terry Cooke to talk about water quality.

MR. COOKE: Thanks, Lou. We evaluated a number of different chemicals, and this is a list of some of the ones that we focused on, that we selected the chemicals based on concern expressed by regulatory and resource agencies in the Bay for certain toxicants. They range from metals, as well as some of the legacy pollutants that Bill Fehring mentioned such as PCB's and DDT's. For the evaluation, we looked at both near field changes during construction activities where materials would actually be moved around the Bay or taken out of the Bay, and the distance from those activities is between 10 meters within near the construction activities to about a kilometer away. For the near field changes, we compared chemical concentrations from one hour averages to acute or short-term water quality objectives. And the short term objectives are objectives designed to protect against exposure from very short durations and immediate toxicity. For both the construction and the operation evaluation, we evaluated far field changes from 200 meters through the whole Bay, including the North Bay all the way through the South Bay. For those evaluations, we looked at four-day or 30-day average concentrations, depending on what the water quality objective has been written in, and we compared those to chronic or long-term water quality objectives, which are lower than the acute objectives. This is a map showing an example of some of the results we are getting. This happens to be for polychlorinated biphenyl and it shows the change in polychlorinated biphenyl for the dry season, one of the four seasons that we modeled which happens to have the highest concentrations. And this is for post-construction, so immediately after the airport's construction equipment goes away and we have the new platforms, what the change would be. And you can see the red colors are increases, the blue colors are decreases. And this is for BX-6 fill, one of the larger platforms. And we see to the south of the new platforms here some increases in concentrations of PCB's and suspended sediment that would occur due to the reconfiguration and the change in currents and physical properties. There is also some decreases up in the top. It is a little hard to see on this slide. To get an idea of how often these changes occur, the NOAA panelists suggested we develop some frequency plots, and these plots essentially show for the very center of this change, how often a given concentration would occur over our modeled period. And an easy thing to look at is, under the zero scale, that is the maximum concentration we saw in the model period. Here is the water quality objective for PCB's in the Bay, this is the no project condition -- we call it the existing here -- and you can see that under current conditions, the Bay exceeds these water quality objectives and the maximum concentration we predicted was around nine parts per trillion. And with the project addition immediately following construction, we predict the concentrations in the middle, the worse part of this plume, would increase by about a factor of 2. And these concentrations would be predicted to decrease over time, or the change would be predicted to decrease as the Bay readjusts. As I have shown on the last slide, there are several perimeters that the Bay currently exceeds. One of the things that we wanted to focus on for our analysis are perimeters that are not currently exceeded, or the areas where they are not exceeded, and would the project actually cause those things to be exceeded. And for the chemicals that we evaluated for the post-construction evaluation, we found a small area on the edge of that sediment plume that would increase polynuclear aromatic hydrocarbons above the water quality standards. Primarily, the rest of these chemicals would either not exceed, or they are currently exceeding, so that the findings were we found no wide-spread new excedances of water quality standards. The lower South Bay is a water quality limited segment and a current concern in regulatory focus, so below the Dunbarton Bridge, we were particularly interested and we found minimal effect on the lower South Bay. And we found minimal effect on the lower South Bay and we found near the tips of the new runways and in the borrow pit area, depending on how that area was configured at the end of the project, we may see increases or changes. For the construction scenarios, as Tom mentioned, one of the evaluations that we conducted was the impacts of the use of the borrow pit on the Bay and how that would cause a change in the Bay. And this is again a similar plot for PCB's showing the changes that were predicted. There are changes where the dredging activities are occurring both in the borrow pit area and off the runways, and we see some increases here in the yellow at both areas. The location of maximum change again is showed in these frequency plots where the existing environment exceeds the water quality objective that we see, about a factor of five-fold increase at the center of the plume for PCB's for the construction scenario. The other chemicals that we looked at -- we did see some areas where copper might be exceeded around the platforms when the dredging activities occur, and again PAH's showed some increases on the edge where they are currently exceeded.

So a summary of the findings near the dredge's concentrations generally increase due to loss of sediments and the chemicals that are associated with that Bay mud. During the South Bay, some of the chemicals are increased in a magnitude of that increase would be influenced by the borrow pit configuration and how that material is actually removed and placed.

Some of the compliance objectives here -- summaries. We did not see large changes in the status of water quality compliance in the South Bay. The existing problems for the Bay -- some of those would be increased near the dredging activities and immediately around the dredging. In the platform area, copper is of concern for a couple of the units that would be dredged.

Now Lisa Hunt is going to talk about how those changes might affect the biology of the Bay.

DR. SCHUBEL: At some point, I would like you to clarify how long the construction period would be.

MS. HUNT: So, as Terry discussed, the process of dredging can stir up constituents in the sediment and result in increased concentrations in the water. So the objective of this part of the evaluation was to consider the potential effects to the ecosystem due to increases in concentrations in the water. The questions we asked were, first, is there a potential for direct toxicity to those organisms that live in the water such as fish and vertebrates and phytoplankton. Then is there a potential for food web toxicity to upper trophic level receptors. Certain constituents such as PCB's and mercury can accumulate in the tissue of fish an invertebrates, potentially affecting receptors that are feeding on them such as fish eating birds or marine mammals. And then we also asked, is there a difference in terms of the predicted effects under the No-Project conditions vs. the predicted project conditions. To develop the approach for our assessment, we used guidance, both state and federal guidance for ecological risk assessment, as well as for dredging evaluations. To evaluate direct toxicity to fish, phytoplankton and invertebrates, we used the results of the water quality modeling that Terry has discussed, as well as site specific toxicity testing. And to evaluate potential risks to upper trophic level receptors, we selected the Double-Crested Cormorant to represent fish-eating birds and the Pacific Harbor Seal to represent marine mammals. We then developed a food web model that predicts the fate and transport of contaminants through the food chain. So we used this model to estimate concentrations that would occur in fish and then, assuming that the seals and birds would be feeding on the fish, we estimated an average daily dose of each constituent. We then compared this estimated dose to a threshold level, above which effects might be expected. The type of effects that we considered were generally chronic sub-lethal effects such as decreased reproduction or development. For evaluation of direct toxicity, we calculated the size of the initial mixing zone based on the dredging guidance. This is the zone in which some dilution would be expected to occur. And according to the guidance, effects would be expected to occur within this zone, but should be avoided outside the zone. So this figure shows the approximate area of the mixing zone around the SFO platform and also the East Bay Shoals borrow site. The approximate size we calculated was about a third of a square mile. The shape and location of the plume is going to change. This is likely to be more elongated, depending on the tidal cycles. The results of our assessment indicated that no increase in direct toxicity would be expected outside of the mixing zone and there would be an increase in toxicity expected to occur in an area of about one-tenth of a square mile, which is about one-third of the size of the mixing zone calculated. That increase in toxicity would primarily be due to the increases in copper concentrations that Terry discussed. And these concentrations would be high enough to affect invertebrates, but not high enough to be expected to affect fish. The results of the food web modeling indicate that even under existing conditions, there may be effects to the reproduction of fish-eating birds and marine mammals due to the combined concentrations of PCB's, Mercury, and DDT. Now when I say that there may be effects even under existing conditions, I should emphasize that there is uncertainty in these results and this uncertainty can be associated with both the exposure or the dose that we estimated, and also with a toxicity or the dose that would be expected to cause effects. And in general for our analysis we did select perimeters for our model that tended to predict a high end of risk, so we expected that what we have predicted is basically a reasonable worse case estimate of risk. For the Double-Crested Cormorant under existing conditions and project conditions, when we evaluated each constituent individually, we found that the concentration of each constituent did not exceed a threshold for effects, but when we evaluated the combined concentrations of PCB's, DDT and Mercury, it did slightly exceed the threshold above which reproduction effects might be expected. For the Cormorant, we assumed that the foraging range would be centered around the dredging area. On the left here, it shows the foraging range that we assumed for the platform area, and over here to the East Bay Shoals. And this analysis assumes that there may be some individual Cormorants just feeding within this area for a period of at least several months, and it also assumes that the fish that they are feeding on are not leaving the area during that period. Now, in fact, most fish species do tend to move around the Bay quite a bit, and especially during dredging they are actually more likely to avoid this area, but we did want to evaluate the worse case scenario. Under this scenario, the maximum increase in dose of each constituent that we predicted to the Cormorant is expected to increase by about 26 percent as compared to existing conditions. Now most Cormorants, as I said, would be feeding in other areas of the Bay as well, and the average increase in dose for Cormorants around the Bay would be more like about two percent.

For the Pacific Harbor Seal, again, we looked at the worse case scenario for exposure. This shows a foraging range centered around the Coyote Point haul-out site, which is the haul-out site closest to the SFO platform. And, again, here we assume that the seals would only be feeding in this area and the fish that they would be feeding on would not move outside of this area for a period of at least several months. Under this scenario, we predicted a maximum increase in dose of about two percent for each constituent.

So that concludes my part of the presentation. I am going to turn it over to Bill Martin, who is going to discuss other types of potential effects to biological resources.

Mr. Martin - Thanks, Lisa. What I would like to talk about now is to give you a brief summary of how some of the physical effects that you saw earlier might effect some of the biological resources shown here. I want to start with phytoplankton. Phytoplankton are an important part of the community. They form the base of the food chain. In the south bay, there are often large blooms of phytoplankton during the spring and those are important to higher trophic levels. At the suggestion of the NOAA panel, one of the things that we did was to look at changes in phytoplankton biomass during the spring bloom. What I would like to show you here are two points, one near the borrow pit and then one a little bit farther south. We modeled a simulated spring bloom which is the -- I guess the pointer is not working -- the upper line on the graph there under low turbidity conditions, and then we added increasing amounts of sediment to the model to look at the effects of the reduction in light on the phytoplankton bloom. And, as you can see, what we expected was a drop in the biomass. What we are looking at here right at the dredge is about a 50 to 90 percent decrease in biomass at that particular point. When we move down to Point 2 under both the no-project and the project conditions, we are outside of the plume and we do not see an effect. Both lines are on top of each other. So what we are seeing there is a localized effect. If that were averaged over the entire Bay, assuming that productivity was homogenous over the entire Bay, which it is not, usually, we would see an approximately 1-2 percent decrease overall.

Benthos -- benthic organisms are the organisms that live on the bottom. In this case, what we looked at specifically were infaunal benthos. Those are the organisms that live in the mud. The project platforms will reduce benthic habitat by about .4 to 1.2 percent in the Bay due to the platforms themselves. During construction, organisms will be dredged up along with the dredging, and so we will have a loss of organisms there, as well as in areas immediately adjacent to the dredging we will see a loss of some organisms due to the high sedimentation rates in those areas. Now after the disturbance is complete in a given area, we expect to see re-colonization by the benthos, first by opportunistic species. The disturbance could favor an increase in abundance of non-native species in those areas. What we expect is that within several months to several years, the natural variability in the benthic communities will begin to mask any further indications of change due to the project. We looked at eelgrass. We have some existing eelgrass beds in the area at Coyote Point, at Bay Farm Island, as well as the Alameda Shoreline. The project will not result in any direct removal of eelgrass and the geomorphologic modeling, the habitat changes do not suggest that there would be any changes to these beds in the long term. During construction, what I want to show you here are some effects from sedimentation, as well as turbidity. This is a figure showing sedimentation rates, the darker areas indicate higher levels of sedimentation during construction. The light pink line around the dredging areas indicates an estimate of where sedimentation might occur over the six-year construction period at any given time. We do not see any overlap at Coyote Point or at Alameda. There is some potential sedimentation that could occur at the Bay Farm Island site. The currents right there are very strong and the sedimentation rates that are predicted are between about zero and five millimeters over a given month. Given the strong current conditions in that area, we do not expect to see sedimentation occurring at a rate that could cause burial of those beds. This is a plot showing average turbidity for the BX-6 platform during construction. For BX-6 and for the smaller alternative A-3, we do not see any overlap of the turbidity plumes with the eelgrass beds, however -- oh, the units, okay -- what we are looking at here generally for this average plume are concentration of about 5-10 mg. per liter above ambient for the most part of that plume. Some higher concentrations are right in the center where the dredging would be occurring.

Alternative BX-R, we do see overlap with the turbidity plume at the Bay Farm Island site. Due to some of the uncertainties with the length of time that the plume could be over the beds, and the fact that the turbidity can cut down the light penetration and cause thinning of the beds, we have said in the report that there is a potential effect to Bay Farm Island from construction of the BX-6 alternative.

Moving on to fish here, this is just a table showing you some of the common types of fish species that are caught in the area. This is based on data from the California Department of Fish and Game over the last 20 years. We saw similar species in the sampling that we conducted for the project. What we are seeing are things like top smelt, jack smelt and Pacific Herring in some of the shallower areas, the Autotrawl sampling caught white croaker, Bay gobbie (phon) and China Perch. This is not an exhaustive list; we have a complete list in the report. The effects that we expect, again, are loss of habitat and, due to that loss of habitat, we expect to see some local density dependent mortality of some of the resident fish. Now these are fish like gobies and flat fish, which live most of their life in a given area of the Bay. Basically what we are saying is that the loss of habitat will create a reduction in -- localized reduction in populations of these species. However, for pelagic species, things like anchovy and top smelt, Pacific Herring, which range throughout the Bay and in and out of the Bay into the Pacific Ocean, we believe that an effect would be less likely and that a population level effect would likely be unmeasurable. We will also see some delays in migration due to the platform structures. This would be for Salmonic (phon) species, Chinook Salmon and Steelhead. We estimate one to two days based on swimming rates, and this would be to the extent that these fish migrate along the west side of the Bay. If they are migrating in the channel or on the east side of the Bay, they would be unaffected by the project. We will also see an increase in hard substrate that may benefit Pacific Herring to the extent that they may spawn on those hard substrates near SFO. Over the last decade or so, spawning as far south as SFO has been rare.

During construction, we expect to see avoidance of the area by fish, both the area around the East Bay Shoals, as well as near the platform, due to the higher turbidity conditions. During construction of hybrid alternatives and pile driving, we have seen on projects such as the Bay Bridge of the Benicia Bridge, there can be an effect to fish from the pile driving noise under water. Also a potential effect to herring spawning near the runway. If they were to spawn near the runway during construction, the higher turbidity levels may have an adverse effect on the eggs. Construction may also alter migration patterns as fish swim around the construction areas, but, again, migration is not expected to be blocked.

I want to move on to birds. These are some results from our winter water fowl surveys that we did in 2000-2001. The first NOAA panel has suggested that the area might be important for species such as Scoter and Scaup. This is the plot of Scaup. The darker colors indicate higher densities of birds. And we are talking about a range of about 500 to about 3,000. You probably cannot see the scale, but this is all in the report. We saw that Scaup were distributed pretty heavily right around the airport. When we look at Scoter, we see that during that time period, they were not distributed too much around the Airport or the borrow site, and this is showing all the water fowl combined. Now what we will see on a permanent basis, again, is loss of habitat in the areas shown here. This is BX-6 on this plot. And just to put this in perspective in terms of numbers of individuals that might be affected based on these studies, looking at things like at the runway area, diving birds such as Scoter or Scaup, and Ruddy Duck, you can see some of the numbers that might be affected there. Western Sandpiper was the most abundant shore bird in the area, you can see their numbers. In general, the numbers tend to be less than about 1 percent. You see a 1.2 up there for Scaup, and that is the percentage of the Bay population during the winter. Again, we have more extensive tables in the report. Marine mammals -- the loss of habitat or the reduction in habitat will create a reduction in foraging area for marine mammals, primarily harbor seals in the South Bay. On a permanent basis, we do not see direct effects to haul-out sites. There is no construction that would occur in any of the haul-out sites. And over the long term, we do not expect to see substantial changes in habitat type that would affect any of the haul-out sites in the South Bay. This just gives you an idea of the haul-out sites, the red dots there, compared with the disturbance areas. During construction we expect that marine mammals would avoid the construction areas, again due to the activity and the noise, and pile driving noise during construction of hybrid alternatives may have an effect on them as well.

Finally, and then endangered species, I just want to touch on a few that we discuss in the report. The Least Tern, there is a colony of least terns at the Alameda Naval Air Station just to the north of the East Bay Shoals borrow site. In the report, we look at overlap between turbidity plumes and the foraging range of the birds. Since they are visual foragers, there is a potential effect on their foraging success. We see very little overlap in the plumes with the foraging range of those Terns there. Clapper Rail -- we did Clapper Rail surveys and there are Clapper Rail in the San Bruno Marsh just to the north of the Airport. There is no construction activity occurring in that marsh. There would be no loss of that marsh habitat. And, again, the long term habitat changes suggest that there would be no substantial effect there. Steelhead and Salmon, we more or less discussed under fish. What we are looking at there are potential delays in migration as these fish move to and from the South Bay streams. We have a lot more detail in the report, so I am hoping you will take a look at that, and with that I will turn it over to Bill Fehring.

MR. FEHRING - Thank you, Bill. That concludes URS's technical presentation and, with that, I will turn it back to Jerry -- 10 seconds. DR. SCHUBEL: Thank you. I want to underscore the period of construction would be six years, and that was mentioned, but I do not want that to get lost. And in case anybody does not remember what a borrow pit is, it is a place where you borrow sediments, so you dig a hole. So you have heard a brief description of the proposed alternatives and you have heard a very brief summary of some of the findings that are contained in a report that, when laid out, would extend across at least two of these tables. I encourage you to read it. It is not going to out-sell the latest Harry Potter book, however. We are now going to take a 15-minute break. We are on schedule. And when we come back, the panel will be up here and we will give some of the panel's reactions to the studies that you have just heard described. Thank you.

(Off the record.)

(Back on the record.)

DR. SCHUBEL: If we could get everyone to come back in and have a seat, please. We are on schedule. We have had a request for a copy of the summary that was presented by URS, and I am told that Tom Bailey at URS would be willing to provide that summary, along with the Powerpoint slides, along with some of the transcript, and that will be available in I am not sure how many days, but I assume that will be days, not weeks. Now I want to say a word before we go to my panelists to my right, you know, in all of our deliberations, we operated by consensus. We never took formal votes, but in every case we have said, "If there anyone on the panel who disagrees with what has been said, now would be a good time to express it." So there are differences among us. We have got smart, strong-willed, independent scientists, but I think all of the statements that you are going to hear represent at least a very strong consensus. And what is strong, it is a little bit like when you talk about certainty and uncertainty, in this case I think when I say a strong consensus, I mean that if, at most, there might be one or two people on our panel who would interpret things a little bit differently. We are going to have brief summary statements on each of the thematic areas that you have just heard, and those responses will come from members of our panel who have expertise in that particular field. But, again, these are interdisciplinary studies and, so, when one panelist speaks, that represents a strong consensus across all of our panelists.

I want to underscore some important take-away messages. This peer review process was in many was an experiment. Nobody has ever done this before in terms of a large infrastructure project. And every good experiment teaches you things, and before we end today, we will tell you some of the things that we learned from this experiment of having a peer review process of a major public infrastructure project. The driving force that engaged most of this on the panel, probably all, to be part of this process, was the hope that it would become a model for peer review of other large projects proposed for San Francisco Bay and for other areas, not that we are going to be the panel in those, but that the process would become a model. And I think the other driving force for many of the panelists who spent so much time on this effort was their strong dealings about San Francisco Bay. It was a good process and it got better as it went along. And the science that was conducted, I think, was better because of this panel and because of the peer review process. And I am going to stop there, but then I am going to come back after all the panelists have spoken and I will have some other comments to make. And so we are going to start and we will do it essentially in the same order that was presented by URS, and in a few cases we have a couple of experts in an area, so only one will be speaking. But let us start with the hydrology and Jerry Galt at the far end.

MR. GALT: Okay. I am going to be talking about the physical processes and hydrodynamic model, but I think as a preamble I should point out that this was really a major undertaking. There were dozens and dozens of scientists working on it over several years. And so when it is described piece by piece, it sounds fragmentary, but we should all keep in mind that the objective here was to take the various components and weave them together into a chain or sequence of inference that would allow someone to make some decisions about what possible effects might be caused by construction at the Airport. With that in mind, we will start with the hydrodynamics and the first kind of question that people were interested in is how does the water move around. What kind of stress can we expect on the bottom, and so forth. To do this, the consultant group picked a well known, well-recognized, extensively tested hydrodynamic model, and basically this model does a number of things -- it divides the Bay up into a lot of little boxes, and then it starts off with forcing in the Pacific Ocean. As the tides move up the California Coast, the water gets higher along the coast and, because of that, there is a slope of water through the Golden Gate Bridge, and the water starts moving in corresponding to that pressure force. What happens then is it moves into the Bay, feeds itself around all the different little arms, gets down to the end of the Bay, eventually reflects off the sides, and sloshes back and forth somewhat like what you get in a bath tub if you wiggled around and watched the water. This model was particularly good at carrying out those kinds of physics. So one of the things you can do is you start driving it with the tides offshore, going up and down, and then you see how the water moves around inside the Bay and what it leads to. And one of the things you can do is there are many many places in the Bay where there are tidal data available -- it is a wiggly line plot that you get on the fisherman's calendars. It turns out that when this model compares against those kind of data, it does very well. It moves the water around in the Bay, puts it in the right places so that when the water goes up, it goes up. If it goes up two and a half feet, it goes up pretty much two and a half feet. And so in that sense you can look at the model and say it is doing a good job and moving the water around so that it represents the tidal prism. And, of course, that is the most obvious physical process that we look at. In moving that water around, you also get a good estimate of the currents, and you saw a picture earlier of the little movie, little Quick Time movie of these vector hours (phon) moving around and basically that is the way that if you were to drop a chip of wood or something in the water, that is the way it would move. Again, the model can be compared to a limited set of current measurements and it tends to do a pretty good job there in those stronger currents. In the channel is a little weaker flow on the flats and so forth. Finally, the model can also predict how fast the water is moving over the bottom, and that turns out to be important because you are looking at stress and that stress will drag along the bottom, can start to move the sediments around, so now we have got into a interdisciplinary program. There are sediment models, then, that take the input from the hydrodynamic model and the pushing that the water is doing back and forth, and move the sediments around. You can also put in a trench site and stir up some sediments and see where they go before they fall back down to the bottom and class (phon) scenarios and so forth. This kind of model is also, because it is made up of little good cells, it is very closely configured to the geometry of the Bay, which is of course important to the tidal motion. This has another little side effect in that, since it resolves the geometry quite well, you can actually change the geometry in a hypothetical way by pretending that you put in the runway, or the build-up configuration, or you have scooped out some of the borrow pit and so forth. So those kind of changes, since it does a pretty good job on what you have already, it is highly likely that it is going to do a pretty good job on the next phase which is to modify the basin, as you would expect from the development that is proposed. Again, this kind of physical model is a good starting place. It starts off with a strong geophysical forcing, it is well known -- the tides through the Golden Gate. It can then also add models that looked at the weight formation, if the wind blows across the water, you are going to create waves, those waves cause some stirring and mixing, and that mixing then again interacts with the sediment processes. Ultimately, the sediment processes interact with biological processes, and so it goes. So, once again, this starts off a chain of inference which is going to be used and seen, you know, throughout this entire report to help evaluate potential change. And I will leave it there.

DR. SCHUBEL: Thank you, Dr. Galt. Dr. Schoelhammer will talk about sedimentation and sediment transport.

MR. SCHOELLHAMER: Thank you, Jerry. As you heard this morning, Sediment transport is linked to other components of the study. Water motion moves sediment in the

Bay. The Project Team developed and applied numerical models to simulate water motion, wind waves, and sediment transport in the Bay. Sediment transports absorb contaminants, so sediment transport is part of the contaminant models used in this study. Sediment deposition and erosion changes habitats used by the biological communities in the Bay, which is another effect of sediment transport and geomorphology. So I will make some comments here on report sections regarding sediment transport and geomorphology.

Project components that affect sediment transport are the expanded runways, the borrow pits, the restored wetlands, and the dredging and handling of fill. At the request of the panel, the project team has considered all of these components. The sediment transport model simulates changes in suspended sediment concentration caused by tides and winds over hours to weeks. The model was calibrated and validated using extensive suspended sediment concentration data collected by the U.S. Geological Survey. The spatial resolution of the model was 200 meters, essentially the spacing of those arrows you saw on some of the diagrams earlier, such that changes in features 200 meters or smaller cannot be resolved by the model. In order to simulate geomorphic and habitat change, the project team extrapolated or extended model results over decades. This increases the uncertainty of the model results because small errors in the Sediment Transport Model grow. The Project Team reduced the uncertainty of the effect of project alternatives by taking the difference between the project and no project alternatives in the difference of those simulations in a way such that the errors mostly cancel. In order to evaluate and further reduce uncertainty, the Project Team at the request of the panel hind cast geomorphic change with the numerical model, evaluated the effect of existing runways and borrow pits on Bay geomorphology and habitats, and made some simple back of the envelope calculations. Thus, methods other than numerical models were used to predict how the project would affect geomorphology and these are described in detail in the report. In summary, appropriate numerical models, alternative analyses, and available data were used in a reasonable manner. Science, however, cannot predict geomorphic and habitat evolution in estuaries with certainty. It is not realistic to expect a better prediction of geomorphic and habitat change with existing technology. Thank you.

DR. SCHUBEL: Thank you. And the Water Quality and Contaminant sections of the report were the primary responsibility of Drs. Ed Long and Russ Flegal. Ed Long will speak first and then Russ Flegal.

MR. LONG: Thank you, Jerry. Toxic chemicals enter the San Francisco Bay Estuary from numerous sources, resulting in concentrations in the water and sediments that can cause toxic effects and will come out in some areas where the concentrations are sufficiently high. Generally these chemical concentrations are much higher around the perimeter of the Bay than down the access of it or in the open waters of the middle of the Bay. It is important in any ecological risk assessment to address the issue of sediment contamination. And URS recognized this important issue early in the process and focused considerable attention on their sediment quality evaluation. Their characterization and classification of sediment quality at the site and on prospective dredge and fill materials followed with a few notable exceptions, widely accepted and sufficient methods, methods that are commonly required in dredge materials in this country. Interpretations of data follow commonly accepted protocols that have been previously published in scientific journals and government manuals. They estimated the future concentrations of potentially toxic chemicals in the water and sediments that would be expected as a result of the construction. They also predicted the concentrations of suspended particular matter that would be expected using their models. The possible adverse biological effects of these future conditions were estimated by comparing outcomes of the model runs with water quality standards, the sediment quality guidelines that are available, and effects levels published in the scientific literature. All of these are commonly used methods. The list of chemicals for which the analyses were conducted reflected analyses that are commonly done in monitoring programs nationwide.

Toxicity tests were conducted on sediment samples to determine if they were toxic or not, using acceptable methods. Estimates of ecotoxicological risk to fish, birds and mammals generally were prepared with the analyses of data from a large body of scientific literature, an approach that is commonly followed in these kinds of studies. They were careful and consistently drew conclusions from the data and other information compiled for the report, and avoided injecting their personal opinions. They also compared their results to those previously published in the literature. The responsiveness to comments and suggestions from the panel was inconsistent, however. In some cases they responded satisfactorily to suggestions, while in other cases they considered and dismissed them with a rationale of some kind. For example, they adopted a sediment classification approach that was suggested, but they were unable or unwilling to do more sampling and analyses to reduce uncertainty. Nevertheless, overall, the quality of the report improved as a result of the peer review process. Generally, multiple lines of evidence were developed to reduce uncertainty in their estimates of risk. These involved examination of monitoring data that were available, as well as data from their own samples that they collected. However, there were several sources of uncertainty that remained. For example, the report did not include aircraft emissions or construction-related emissions such as dust, as a source term (phon) to the Bay. And they did not include estimates of human health risks attributable to consumption of fish. Now, it is important to understand that these topics were to be covered in other reports, and then the EIS and EIR, and they were outside the scope of this particular report. Nevertheless, they have not yet been addressed. Risks of possible effects to resident bottom dwelling fish were not included, whereas such effects have been reported for local fish in the Bay by other investigators. The chemical analytic detection limits and methods for PCB analyses, the sediments were sufficient to estimate risks of acute toxicity to invertebrates, but not for estimates of risk to wildlife. It is important to understand that predicting future ecotoxicological conditions is difficult. Some people might say that predicting these things is not rocket science. Indeed, it is not. It is more difficult than rocket science. With a rocket, you can see the rocket in front of you.

It is my opinion the summary that the report overall represents a significant market in time of our understanding of the Bay, and therefore is a significant contribution.

DR. SCHUBEL: Dr. Flegal.

DR. FLEGAL: Yeah. Ed and I probably should have flip flopped because I am going to briefly comment on some of the aspects of the water quality models that were then used in those risk assessments. First of all, thank you. It is nice to be here with some people other than URS and their associates. I wonder why you are here on such a good day, but it is your choice. San Francisco Bay is arguably the most extensively studied estuary in the world, certainly in terms of the sources, sinks and cycling of contaminants within the system, and the URS group took full advantage of that relative wealth of data to incorporate in their study. This enabled them to incorporate real high quality data in their models to estimate the ranges of both 1) the levels of contamination in Bay waters and sediments, and 2) the extent of that contamination under different scenarios. The model of estimates have limitations as previously pointed out in the discussions on the limitations to the fiscal and geological models that increase as you got up in complexity, and all the way up to the biological models that you will hear about in a minute. And, as I am sure the URS group will agree, the maps they produced to illustrate the current and potential distributions of contaminants in San Francisco Bay waters and sediments, indicate a precision that is too great. There simply are not enough data either for water quality or sediment quality to provide the level of resolution that their maps infer. Now as the URS study and our concurrent reviews of the study continued, and as you have heard, some of us wondered if they would ever end. We continued to add new requests for the URS group to put their models in perspective by comparing the projected results of their data with the data generated by others using different methodologies, both in San Francisco Bay and elsewhere. And with regard to the modeling of the chemical contaminants in the water and the sediments, they complied with all of the requests all of the time. More important, in making the comparisons, they found in some cases their results were remarkably similar to those that others obtained using different methodologies. These independent corroborations provide additional confidence in the applicability of the URS models of projected distributions of contaminants in San Francisco Bay waters and sediments. In summary, I commend the URS group for their responsiveness to our requests to 1) use the best scientific data in their water quality models, and 2) put the results of those models in perspective by comparing them to the results obtained by other investigators using different methodologies that have or are in the process of being published in peer reviewed scientific literature. This protocol is the accepted methodology for advancing scientific knowledge.

DR. SCHUBEL: Thank you. On Habitat, Dr. Callaway.

MR. CALLAWAY: Thanks, Jerry. I also want to second Russ' thanks to all the audience for spending your morning coming here and showing your interest in the Bay by spending more morning listening to what we have to say about these issues. And you are probably all aware of the importance of wetlands around the Bay and the loss of the majority of wetlands around San Francisco Bay, the importance of these habitats for birds and mammals and endangered species. So it is obvious that there is substantial interest in trying to evaluate the impacts of these large scale projects like the runway expansion on wetlands and other intertidal habitats around the Bay. I am going to focus entirely on wetland issues. And I will try and be brief in discussing the impacts to wetlands, in part because the report is pretty brief in evaluating wetlands. And I should add that URS had plans to develop a separate and more detailed analysis of wetland issues related to this project, but that has been put on hold. So I will only address the things in this report. In evaluating the direct impacts to wetlands, the analysis is pretty straight forward. The direct impacts are primarily to subtidal habits, not intertidal mudflats and wetlands. And the direct impacts to salt marshes, just a few acres out of the thousands of acres -- or thousand to 2,000 acres of total impacts. But the much much bigger unknown, compared to the direct impacts, is in evaluating the indirect and long term impacts to wetlands and intertidal mudflats, and that is trying to think about what might happen to these wetlands that are outside of the airport due to changes in hydrology and sediment issues that Jerry and Dave have talked about.

This concern for indirect impacts to wetlands is important because wetlands exist in a very small range of elevations and they are very dynamic in terms of how stable they are in that things like sea level rise or changes in sediment rate can have significant effects on long term stability of these wetlands. So in evaluating the indirect impacts, URS primarily used hydrodynamic and sediment modeling that has been addressed, and those models, as has been stated, used the best available data. The challenge is in taking those physical models and then linking them to some of the biological changes, and it has been pointed out, each time we put different kinds of models together and put different components together, we increase the complexity and uncertainty of our predictions. The two biggest concerns in terms of the uncertainty of the model for predicting changes in wetland habitat are the scale of the model and the focus of the model. In terms of scale, the model is very effective at predicting large scale changes and subtidal habitats changes on the order of a meter or more. But, as I mentioned, wetlands are sensitive to very small scale changes in elevation, just a few -- maybe 10 cm, a few inches or more of change could lead to changes in vegetation type of shifts from a vegetated wetland to a mudflat. And the scale of the model output is much greater than this scale of sensitivity for the habitat. So the model -- it is not very useful in predicting these small scale changes in shallow habitats. Now in terms of focus, the model focuses primarily on subtidal habitats, as well as intertidal mudflats. The model intentionally excludes in terms of hydrologic and sediment transport, excludes intertidal wetlands, vegetated wetlands. And so the predictions of shifts in wetlands are based on changes in adjacent mudflats. So those two issues, I think, are the biggest remaining challenge in trying to predict outcomes.

These challenges are a result of the fact of lack of data about these information and also the lack of tools. URS did use the best tools that are out there, so they really just are not -- as Dave mentioned, the challenge of looking at geomorphic change is really a substantial one. So given all of these challenges in terms of models, we recommended that URS also add some additional analyses, as Dave mentioned, and they were very responsive in doing that. For the most part, URS was very responsive in addressing the concerns we had about the specifics of the model and other approaches, but there are those -- the two issues of scale and focus -- that are difficult to address but really would require substantial additional work outside of what has been done. So in order to reduce that uncertainty, we need much better data on shallow water sediment dynamics, on long-term sediment dynamics, and linking the relationships between suspended sediment concentrations and accretion rates, and mudflats and wetlands. So, in summary, I think the model and the other analysis has gone a substantial way to addressing some of the shifts in the deeper water and intertidal mudflat habitats, but in looking at wetlands, there still remains substantial uncertainty in addressing those changes.

DR. SCHUBEL: I want to say a word about primary productivity and the spring bloom. If either Dr. Cloern or Dr. Powell were here, they would be making this statement. This is probably -- no, not probably -- this is the area where there was the greatest disagreement among panelists, and I think we still had a consensus. The spring bloom is a characteristic and important phenomenon of San Francisco Bay. It is important not only to the primary productivity, but also to the secondary productivity. And our request, and with our endorsement, URS conducted a simple kind of spreadsheet analysis of how construction might affect turbidity and, as a result, primary productivity during the spring bloom. And you saw some of that in the presentation. Unfortunately, this approach did not eliminate all of the panel's concerns. That is, it did not provide a sufficiently high degree of certainty in terms of the forecasted effects on this important phenomena. So given the importance of the spring bloom to primary and secondary productivity of the Bay, in fact to the entire food web, the panel recommends that a more sophisticated modeling effort be undertaken, and that it should include more complex, multi-variant formulations that are accepted as representing a richer, more insightful understanding of the processes controlling the onset, the development, and the decay of the spring bloom. It is possible -- and I would underscore the word "possible" -- that using these formulations in conjunction with appropriate statistical geophysical forcing that one could distinguish among potential runway project impacts and provide a stronger answer to this important question. And I think all of us recognize that this is not a trivial undertaking, but believe the importance of the phenomenon justifies further investigation.

All right, what about the benthos? Dr. Nichols?

MR. NICHOLS: Yeah, the benthos that -- you saw the definition of benthos provided for us on the URS slide, but it is the community of invertebrates -- clams, worms, crustaceans that live on or in the bottom sediments in the Bay. And these animals represent a very important food source for bottom feeding fish and diving ducks, and thus they are very important components of the Bay's food web. These species, because they live in or on the sediments, also provide a vector for contaminants that are in the sediments because they feed in the sediments, as the vector for moving contaminants from sediments to fish and wildlife species that feed on them. So they are a critical part of this system and a critical part of the well-being of the Bay. The stated goal of the URS study of the benthos was to characterize the composition, distribution, and abundance of the community of bottom-living invertebrates in the South Bay that would potentially be disturbed or eliminated during the construction of the runways. The presumed effects of the runway project were described as following into two categories -- construction effects and operational effects. The construction effects were those associated with habitat disturbance, essentially with dredging or disposing of spoils, or filling, and so forth, recolonization after the cessation of any disturbance, and the potential in that re-colonization -- potential for exploitation by opportunistic exotic species. The operational effects were, once it is built, once the new runways are built, would be certainly the loss of the soft sediment habitat under the new runways. Increases in hard substrate -- you are replacing a soft mud environment with an environment that has, depending on the construction type, rocks or piling or something, upon which many organisms will establish themselves, including many exotic species, lots of the exotic species that have been introduced in the Bay are those kind of species, as well as changes in the soft bottom habitat types around the existing runways. There would be a changing of the habitat that exists there now. URS consultants designed a one time survey of the benthos in all of the regions that would be subject to dredging, borrow sites, rehandling sites, disposal sites and construction sites. The data from the samples were analyzed with standards to digital techniques, to distinguish the relationship between the species found at each location sampled and the characteristics of the environment there such as water depth, sediment type, and salinity. To expand the geographic coverage and to verify the appropriateness of their identification of the different species assembled, URS consultants reviewed data from other studies. The results of these studies showed, like all previous studies of the benthos of South Bay, that while in general the species found were representative of the broader South Bay, there was considerable variability in the species composition from place to place within the Bay, and there were indeed several different discrete assemblages that appeared to be associated with either specific water depths or sediment types, or a combination of those. Also, none of the invertebrate species found at the sample sites was unique in any way, and many of the species were found to be exotic species. At our encouragement, the study was expanded to include consideration of temporal variability in the benthos. The provided a spatial context for the benthos of South Bay, and we thought it is important to examine the temporal variability. In other words, how much does the community at any site change from month to month and year to year, because it is in that context one has to look at impacts of any particular disturbance. This was possible through the examination of other available data sets where repeated sampling of individual sites over several years have been carried out. The analysis of the repeat sampling data confirmed what has been shown in many previous studies, that there is very considerable variation in the composition of the benthic community over all time scales examined. The combination of the spatial and temporal variability of the South Bay provides the context within which any specific human impact must be evaluated.

The URS consultants concluded after their studies that, while there would obviously be loss of habitat at the site of the runways, that is a given, and changes in the adjacent habitat hard structions changing in the sediment regime around any new runways, there would probably be no measurable longer term impacts in the broader South Bay community that could be distinguished against that background of the very large spatial and temporal variability that I mentioned in species composition. And this variation has many causes, both natural and human induced, including the new constant arrival of exotic species. So the conclusion was that there was no measurable longer term impacts away from the side of the runway that could be distinguished from this normal variability. In the context of the variability of the community of animals and the typically observed rapid recolonization of bottom sediments by these species that inhabit South Bay following disturbance, and this recolonization is usually within months, the study's finding of no obvious long term effects away from the runways themselves is reasonable.

DR. SCHUBEL: Thank you, Dr. Nichols. I have two fish experts, Ed Hobson and John Stevens, and John is going to speak for the fish. MR. STEPHENS: Fishes are important to the various members of the Bay ecosystem. Fish from such an environment have evolved in a highly variable habitat -- salinity, temperature, turbidity, flow, etc. They are therefore more adaptable to change than species in many other marina environments. When we entered this process, URS had already designed and completed their field studies. They had elected to expand at the study site the sampling program carried out throughout the Bay by Fish & Game the last 20 years in the Interagency Ecological Program. This study used otter trawls (phon), mid-water trawls, and some beach seines to sample fishes. URS proposed otter trawls and beach seines plus plankton samplers for fish eggs and larvae. We felt that limiting the study to these samplers would not accurately describe the local assemblage in an ecological sense, and we requested that they use a multi-sampler approach, which would yield better data on diversity and abundance of fishes. Such data would be compared against their previous years sampling program, as well as the Interagency long term data. We also suggested they expand the use of data collected earlier by others, both published and unpublished. San Francisco Bay is one of the world's most studied bodies of water and there has been virtually no attempt at bringing all this data together, at least as far as fishes are concerned. They responded to our request by completing a season of multi-sampler studies which increased our knowledge of the local fish community considerably, though a complete year of data would have been preferable. They also expanded their search for earlier data sets and incorporated these in their report. In this well-studied Bay, this study represents the most comprehensive site specific fish sampling that has been carried out. Even though the data are limited in time and space, they constituted the best study available. A number of species demonstrated to occur in large numbers here appear as missing or rare in more traditional sampling programs. As is obvious, fishes occupying the runway footprint will be excluded by construction in all of the alternatives. Predicted habitat changes from physical and sedimentary models are not of a scale to allow detailed analysis of subtle changes that may occur in the associated fish assemblage.

The development of a habitat association index was recently begun by URS, but unfortunately has had to be terminated. Such an index would have been a help in further look at variations in fish assemblies with habitat change. Analysis of fish loss due to construction effects utilizes relevant experimental data coupled with calculated abundance estimates of the selected species. It is difficult, of course, to use these results in such a long term construction study. Six years of construction and perhaps synergistic effects of turbidity and noise, you know, are difficult to evaluate. All in all, the URS team has done a very good job with its analysis. Their study and their conclusions are reasonable and well supported by their data.

DR. SCHUBEL: Thank you, John. And on the birds, Dr. Janet Hanson.

MS. HANSON: Thanks, Jerry. And thanks to all of you for coming today and for your interest in the Bay's health and its wildlife. Just to set the stage, San Francisco Bay is a major stopover point for migratory birds on the Pacific flyway. It is vital to the survival of many species of water birds. For example, it is a site of hemispheric importance for the flyway shore birds. And please note that 70 percent of that population is found in the South Bay. When this panel was convened, URS was already well underway with avian surveys and literature searches. Our goal was to ensure that research included all the major groups of birds likely to be affected by the proposed runway expansion, like shore birds and water fowl, and that that research also included special species, particularly those already listed as threatened or endangered. URS used standard field methods to evaluate bird populations, using the immediate area of the airport. These protocols utilized different methods of detection and take into account many variables such as seasonality, tide cycles, time of day, and local movements. URS also sought out existing data sets on status and distribution, as well as other factors identified in the conceptual model, such as contaminants and fish eating birds. And URS followed our recommendations for further field work and data collection, particularly concerning California least terns. All this work was necessary in order to construct a before and after picture of effects caused by the expansion project. The primary effects on birds in the immediate area of the project are those of displacement and probable mortality due to habitat loss and conversion. Predicting effects on the South Bay's bird populations hinges on predicting changes in South Bay habitats that would result from the projects six years of construction and long term operation. My understanding, and you have to understand this has been a big educational process for me on modeling and hydrology, my understanding is that the modeling efforts predicted no significant changes in the South Bay's open water habitat, and that the models used, while the best available, are not sensitive enough to predict changes in its intertidal habitats such as the mudflats that provide important foraging for migrating and wintering shore birds. Evidential, models lose resolution as they move from the physical to the chemical, and finally to biological properties, as the complexity of the ecosystem grows. It is also not possible at this time for the models to accurately predict the cumulative effects on birds of contaminants released into the water column by the dredging needed for construction or of noise and/or disturbance created by construction and operation. As one of my colleagues pointed out yesterday, it is important to recognize the difference between a finding of no effect vs. no conclusion. The latter is true for the project's cumulative impacts on the South Bay's bird populations, despite the best efforts of this panel and URS thus far. This report pulls together all of our current knowledge of the Bay's ecosystem and the tools available for today for evaluating its conditions, including the conceptual model, which will be valuable to everyone interested in the Bay's ecosystem and eventual restoration. This report also exposes the gaps in our data and understanding of this complex system, and how changes in its physical properties affect the birds dependent upon it. Thank you.

DR. SCHUBEL: Thank you. And on marine mammals, Diane Kopec, please.

MS. KOPEC: Thank you, Jerry. While several species of marine mammals occur in San Francisco Bay, harbor seals are of primary interest as they are the apex predator and the only resident marine mammal found in the Bay. Harbor seals feed on Bay fish. Throughout the year, seals use isolated shoreline habitats called haul-out sites that are critical to the seals' health and reproduction. Seals habitually haul-out at particular locations around the Bay, year after year. The two potential areas of impact to harbor seals are changes in foraging and haul out habitat, and changes in the accumulation of toxic contaminants. In general, there was a good discussion of potential changes to seal habitat with the following exceptions: the sensitivity of the sedimentation transport and hydrology models is not at the scale necessary to accurately predict if there will be changes at specific haul-out sites or foraging areas. The models are designed to address deep water habitats and not intertidal mudflats and adjacent marsh habitats. The spatial scale is too broad to predict the potential changes in bathimetry around specific haul-out sites. There is limited knowledge of the linkages between the distribution and abundance of prey fish and seal foraging activity, and this limitation greatly increases the uncertainty of predicted changes in seal food availability and exposure to toxic contaminants associated with the proposed construction. Based on our recommendations, spring aerial harbor seal surveys were added to provide current information on seal numbers and reproduction in the Bay at the three active haul-out sites closest to the Airport. Several years of data will be required to determine the status and trends of seal numbers at these sites. Several supplementary studies that were scheduled for inclusion in the EIS are needed to fully assess project effects on seal habitat. These studies, which are not currently available, include the effects of noise on haul-out activity and prey availability, and the cumulative effects other large scale construction projects will have on the regional seal population in the Bay.

The Technical Report provides a good background description on contaminant levels in San Francisco Bay harbor seals and includes a discussion of the additive effects of selected contaminants, including PCB's, PAH's, DDT's, and Mercury. Existing levels of toxic contaminants in Bay harbor seals are comparable to levels associated with health effects in studies with captive harbor seals. The report focused on harbor seals as one of two species used to predict broad scale health effects on the ecosystem resulting from potential changes in contaminant levels associated with the airport project. URS should be commended for including actual toxicity data from harbor seals, providing a sensitive indicator of potential health effects. Bioaccumulation simulation models were the sole method used to assess wildlife health risks from current and predicted levels of PCB's, mercury, and PAH's in the Bay. At our request, URS planned to verify the results of their contaminant bioaccumulation models with hindcast simulations, using existing contaminant levels in Bay harbor seals. If that analysis is completed, the results will reduce the uncertainty of the model predictions. This Technical Report was vastly improved during the review process. The panel's ongoing input in the early drafts of the report stimulated additional field studies, literature reviews, and data analysis, most notably the discussion on additive effects of contaminants.

DR. SCHUBEL: Thank you, Diane. Almost everyone, and maybe everyone up here, mentioned something about modeling in one respect or another, so I want to go back to you, Jerry Galt, to say just a little bit about modeling in this context -- what it can do, what it cannot do, and why we turn to models. But do not give us the 50-minute lecture, please.

MR. GALT: Okay. I think among scientists and the public, in general, the idea of what a model is varies greatly. There is all different kinds of models. When most people first hear about a model, they assume that it is a computer code that runs and produces graphs or pictures or tables, or some such thing. This project was full of models like that. Those models are particularly strong for a couple of investigation kind of studies. The first thing you can do is interpolate. If we have the tidal model run and we find out that it matches the current meter over here, and then another current meter over here, it is doing a pretty good job, and we can look at all the points in between. And in fact one of the pictures you saw was equivalent to having a current meter every 200 meters in the Bay. That is a huge increase in information over anything you could possibly gather. So that is a very important use of models. And again, you can get pattern information that is consistent and impose physics which gives you a much better insight on how things work. Another thing you can do with those kinds of models is extrapolate -- and that means go beyond your data set -- to places where you have not been before and the kind of conspicuous use in that form here is when you plop a proposed runway down in the middle of your model. That is something you could not do no matter how many current meters you had because it is not there yet. So, again, models can be very useful in terms of looking at that sort of thing. In another way, though, again, as I mentioned early on and virtually everybody in the line-up here has said one time or another, the idea here is to take a great deal of information from various places and cobble it together so that you can get an inference of how one thing affects another, which may affect another, and to come up with a rationale for how to use the information. It is really a form of information use strategy. What are you going to do with all that different kinds of information you get? And this is what we think of more as a conceptual model. And you saw a picture of the conceptual model up there and it had a lot of boxes and arrows and stuff. Each of those arrows really represented information flow, that is to say, "We are going to get output from here and we are going to see how that goes on to the next." I think one of the axioms that virtually everybody has heard about models and computer programs is "garbage in equals garbage out." A corollary to that is "fuzzy in equals fuzzy out." And since we are dealing with a hierarchy here where one thing feeds into another, which feeds into another, what we are interested in is the propagation of that fuzziness. And, again, if you have got a very tight model at one end, then you are introducing some small amount of uncertainty into the next level as input, that will propagate through to the output. When that is used in the next level, the uncertainty propagates and the fuzziness increases. And virtually always at some point, you find that the output from the model is descending into a area of statistical uncertainty or numerical noise, or biological variability, or some such thing. So this is one of the concerns that the panel came up with very quickly, and from almost our first meeting, we said we want a better conceptual model. We want a better description of how the chain of inference is going to go and what your information use strategy is going to be for how you get to the next step. And URS said, "That's a good idea. We will do that." And so they worked on it and they came back and we said, "Good." And then we said, "Wait a minute," and, in short, we kept upping the gate, and there was a great deal of conversation back and forth, and what we went through was a hierarchy of ascending conceptual models that were sharper and better focused in the way that the information used strategy came out. Another thing that is critically important in any kind of applied science which is going to be used to estimate what the public is supposed to do next is that it is at least as important to know what you do not know as to know what you do know. And, again, this kind of analysis was very helpful in trying to watch where the fuzziness got beyond the point where it was burying the signal. And, again, this is not new to this project. This is not unique to this project. This is true in every project. Most projects are as up front about talking about it. Most projects kind of, "Well, we did a good job. Believe us." Once we looked at this, we asked for more sensitivity analysis -- again, a sharper conceptual model and better sensitivity analysis. What does sensitivity analysis do? It again tells you where it is you have strength and where it is you have weaknesses. That sensitivity analysis can be a whole bunch of things. One of the things you can do is what people or the modeler think of as numerical exploration. You say, okay, here is the input. It is a piece of data. What if I perturbed that data? What if I was wrong? Let's say I was, you know, two degrees low in my temperature or two degrees high? So then you can use the model to explore the situation space of output fuzziness compared to situation space of input fuzziness. So that is a good way to develop confidence in the model. You can also go to methods that do not have anything to do with modeling, but they improve your information use strategy. One obvious one is hindcasting. You can have a couple of sets of data, you can set the model up for the start, run it for a while, and see what the second comes out. In some ways, you have got a perfect numerical experiment, except God did this one and you did that one. This led and often leads to places where you can say, "Oh, well, you know, the model is pretty good about this, but it is not so good about that." Okay, so, "This is something we can have more confidence in, this is something we can deal with in terms of looking at the next step in the inference." Another thing you can do that has nothing to do with models is realize that San Francisco was not the first place that had an airport that needed a longer runway and had an estuary nearby. There are a lot of places around the world who have solved their runway problem by building into an estuary -- Sydney, Hong Kong, Tokyo, Honolulu National Airport. All of these places have extended their runways out into a Bay. So you can sort of go back and say, "Okay, did you guys come up with any -- was there any bad news after this? How did you gauge the consequences of what happened?" That again strengthens your confidence in the inference of the model. Kind of as a last step, it is useful to take advantage of the fact that all of us on the panel are young vibrant people, but somehow between us we probably have a number of centuries of experience. That experience is not building a runway in San Francisco, but it is looking at our own domain specialties for a very long time, under a variety of marine conditions. So we can put up some red flags, you know, if I saw a model that started to violate hydrodynamic principles and, in fact, was out of sync with Newton's second law, that would start raising a flag with me. I would look at it and, "Wait a minute!" Somehow you have managed to create water over here that is not likely to be true. And so, again, those kinds of reality checks from an independent peer group also help strengthen the outcome of what you come up with. Well, all in all, our readings were active. We had a great deal of exchange back and forth. Some of us enjoyed that. Maybe some of us did not enjoy it, but, anyway, we did it.

DR. SCHUBEL: Jerry, are we coming near the end?

MR. GALT: Yes.

DR. SCHUBEL: Thank you. Sea level went up 10 cm.

MR. GALT: I have one more. The bottom line is that this program got stronger as time went on and ended up a credible and very large work. Does this mean that all scientific questions on environmental issues in the Bay are now solved and we should tell the National Science Foundation to cut funding for any other projects? No. But for the areas that this covered and the domain it was focused on, I think we can have confidence in the outcome.

DR. SCHUBEL: Thank you. So no model is any better than its underlying conceptualization and there are some problems, processes, and phenomena that can be only investigated using models. There was a very interesting OPED piece in the New York Times a couple of months ago. It was the 50th anniversary of DNA and the person who wrote the OPED piece is a Professor of Applied Math at Cornell, and he pointed out that it was also the 50th anniversary when Ferme (phon) and five of his colleagues demonstrated -- now these were not the experiments under the squash port (phon) -- so they demonstrated that a new kind of -- new way of doing science, and that was with computer modeling, and the evolution of that over the last 50 years is pretty amazing. It is a very good book called "Sink" that this fellow wrote. All right, I am going to make some closing observations, but we want the cards passed to the aisles and picked up so that we can try to address your questions, and Dr. Fehring, I am going to give you the alert that, after I am done, if you want a couple minutes to respond to anything that you have heard, we will provide you up to five minutes. Okay? All right, so while the cards are being collected, some closing observations.

The responsiveness of URS to our comments increased over time and with only a very few exceptions, they reached a level that provided members of the Panel with the level of scientific certainty they felt was appropriately sufficient for their assignment. Now responsiveness could take several forms. They could agree with our suggestions and then go on and do the analysis recommended, they could disagree and provide a rationale why they disagreed with us, and both of those happened and there were only a very few incidents where I think there was neither of the other kinds of responses -- but very very few. The responsiveness was better to our written comments than to verbal comments, and that is a lesson that we are going to carry over in our final report as this kind of process is repeated. The final report was significantly enhanced over previous versions, both in terms of scientific veracity and its readability. The study on the peer review process identified a number of various areas for additional research, and we will have those in our final report, and we believe that those should be carried out if this moves to an EIR/EIS. And I will not list those now, but they will be in the report. The URS studies provide us with a set of modeling tools that will be useful in evaluating the hydrologic and sedimentalogic effects of other proposed perturbations to South Bay. And the hydrodynamic models were an appropriate choice. The existing sediment transport models were enhanced and the modeling of wind wave effects on sediment transport was a significant advancement. The integration of existing data and information with new data and information by URS constitutes an important contribution to our understanding of the properties and processes that characterize the Bay. It should not be surprising that there were no major new insights. This is a very well studied system, and so I think the study affirmed and gave us greater confidence in things that we have believed, and, as was mentioned by Jerry Galt, if you took the total number of years of experience of this panel in studying the San Francisco Bay, I am not sure how many centuries it would be, but it would be a lot of years. The modeling approaches, as

Dr. Galt has said, they were appropriate to the task, and if the spring bloom is to be investigated along the lines that I mentioned, it would require a different level of modeling. The one overriding recommendation I think we have is that, if this process is to become a model for other peer review panels, the peer review panels should be involved from the very beginning, that is, during the planning phase before any field data are collected. The disconnect in time between Panel 1 and Panel 2 was unfortunate because several sampling programs had already been designed, and in some cases most or all of the samples had been taken before we started. Now, in some cases it was possible for URS to go back and collect more samples. You have heard a lot about uncertainty and mentions of the role of science in decision making, and this panel throughout this process urged URS to look at as many lines of evidence as they could to reduce the level of uncertainty, and we used to call this the weight of evidence approach, and we think they did a good job of examining historical data, information from other systems, and so on. Does any uncertainty remain? Absolutely. Uncertainty is what drives science and the quest to reduce it, and it can never be eliminated. As new questions are answered, others emerge. And Lytton (phon) Caldwell, in a review of Michael Zimmerman's excellent book, "Science, Non-Science, and Nonsense," describes science as a process of "separating the demonstrably false from the probably true. It is a fundamental underpinning of science that only falsehoods, not truth, can be proven." And the late Richard Fineman, who did so many remarkable things, that also led to him receiving the Nobel prize, said, "Scientific knowledge is a body of statements of varying degrees of certainty, some most unsure, some nearly sure, none absolutely certain." The role of science in decision making, again, I want to go back to a point I made early, it was our responsibility to oversee the quality of the science done by URS so that, as the public makes decisions about what it wants to do, the quality of the science would not be in question. And, again, as Fineman points out, "If you know something you are able to do things scientifically, but the science does not come with any instructions as how to apply it." And I think with that I am going to see if -- Bill, would you like to make any comments before we go to the questions? Then I will have some final observations.

DR. FEHRING: Thank you, Jerry. I will be extremely brief. On behalf of th URS team, I would like to express our thanks for the opportunity to participate in this process. It has certainly been a professional and intellectual challenge, but is has also been a lot of fun.

I think the meetings that we have had have been a learning experience for all of us and I think probably as much for the panel themselves. We agree, I think completely, that the report was improved substantially by the panel process. We recognize the limitations and the inherent uncertainties of mathematical models or models of any type, and the continued need for the dependence on professional experience and judgment by committed scientists to making conclusions about changes and ultimately to making decisions in the public sector about whether we go forward with infrastructure projects. And with that, Jerry, I think -- why don't you take over with your questions.

DR. SCHUBEL: Some of these belong up here and some actually belong to URS. The first one, "Did URS consider studies of the effects of expanded runways from Hong Kong and Sydney Airports?"

DR. FEHRING: Yes, in fact we did consider those studies. We have in fact examined the monitoring program that followed the expansion of the Hong Kong Airport, which I personally was involved in the studies prior to it. The interesting fact is, though, that in almost all instances, there are great studies done before projects are undertaken and an almost worldwide failure to follow through with detailed monitoring. There are studies of the Hong Kong

Airport, but when you look at them, they are still going on, and they really do not address many kinds of the issues that we were dealing with here. We in fact are doing some of those studies as a company, and I know what their EA reports look like, I have read them, I have helped edit some of them, and they just simply do not address many of the issues. There is in fact, I think, and this is infrastructure of projects across the world, once the project is built, there really has never been an intensive follow through on a lot of projects that gives you the kinds of issues, information you would want, when you face the next one. And that is a failure much beyond just airports.

DR. SCHUBEL: Yes. I would certainly agree with that. When society does choose to undertake one of these major projects, it is the grand experiment and the observations should be made. I am not sure who should answer this one. I am going to read it and I hope that someone will jump forward with great enthusiasm. "Several times today, panelists indicated that the models will not predict long term effects accurately. How certain can the public be that the Bay would not be negatively impacted?" Who would like to begin to respond to that? "Several times today, panelists indicated that the models will not predict long term effects accurately. How certain can the public be that the Bay would not be negatively impacted?" John, you mentioned it. Dave, I think you mentioned it. Jerry, you mentioned it. I do not -- and I think the two of you mentioned it. Who would like to start on that? It is obviously a tough question. All right, Jerry.

MR. GALT: I will give it a quick start. There are many cases where a model exists which predicts what is going to happen in the short term. And for dynamic systems where the further away you get in time, the more disconnected the initial state and the final state become, the more difficult it becomes to do long term modeling. I think as an example, and this gets to another field, but I think everybody is familiar with it, there are hundreds and hundreds of models around that can forecast the weather. Every major country in the world has a weather forecasting center where they forecast what the weather is going to be tomorrow and the next day. You cannot take those models and simply run them a long time and get climate change. Those sound like kind of the same problem, but they are not. And if you want to look at the level of effort that is required to look at climate change, we are talking about thousands of person years of research, millions of dollars in terms of trying to verify the statistical relevance. Many models will predict it is going to be warm tomorrow; they cannot predict how many days it is going to be warm 20 years from now. And so this turns out to be a very different problem that has to do with extremely complex statistics. And in the biological or the environmental area, I know nobody who has been able to do this. And, again, if you want to look at a role model, think about climate change. You know, an awful lot of effort has gone into that and there is still some contention about how it works.

DR. SCHUBEL: Anybody want to add anything to that? Fred?

MR. NICHOLS: Yeah. Since I was one of the -- maybe the only person who did not use the word "model" in his presentation, I fall back, and maybe it has been because I have been studying San Francisco Bay for a long time, that I fall back on the importance of intuition and experience as much as on models to try to understand the long term effect of something. And to use an example, and it is a concern all of us have, is what is the long term prognosis for the shoreline of South San Francisco Bay, for example, in the context of wetlands or whatever. And what are the forces acting on the edge of the Bay that need to be considered in addition to a project? Intuition and long term experience says that the shoreline shows, has demonstrated that the shoreline of San Francisco Bay is very dynamic and in places we are having rapid erosion, other places we are having accretion of new sediments and wetlandage, and our experience tells us that that is a fact of life no matter what you do, and the question is how do you evaluate the import of any project like new runways on that. Intuition says that it will be very difficult to show the effect of any individual project given the natural ongoing dynamics of the edge of the Bay. So one has to fall back on -- since modeling does not get us very much -- as I understand it, it does not get us very much detail on what happens at the edge of the Bay. We have to fall back on intuition and experience. And therefore, many of us have called for detailed, continuous mapping of the edge of the Bay, essentially in perpetuity to begin to understand how it is changing and what the quantity of change is, and eventually getting at what the causes might be. I do not think modeling will ever get us to being able to do that ahead of time.

DR. SCHUBEL: And I would just -- Fred, you do use models. It is because of your long experience you have got a conceptual model of how this system works --

MR. NICHOLS: Yes.

DR. SCHUBEL: -- and so if there is a perturbation, you process that in your mind and that is what the intuition is all about. Who else would add to anything -- all right, Ed?

MR. LONG: The question, if I understand it, was how do we assure that the Bay will not be impacted. And what I heard from Bill's group is that the Bay will be impacted. So if you are a clam living happily under the footprint of the new runway, this is going to be a severe impact on your livelihood. From that perspective, it is a pretty severe impact. I think the question is how do we reduce the scale of the impact, and the reduction of the scale has to be addressed in the models that were run and the use of the model to discriminate between the different alternatives.

DR. SCHUBEL: Dave?

MR. SCHOELLHAMER: This was a question about, you know, how certain are we that was, I think, very perplexing for the panel and it is a very difficult question to address not just for the project team, but just for science in general, especially with regards to the geomorphology of the estuary. And our response or our sort of challenge to the project team, which they rose up to, was to try to demonstrate as much the certainty or the uncertainty of the models and the model results that they present in their report, and so we asked them to do things such as the hindcasting the geomorphic change, evaluating the effects of the existing runways and borrow pits, in making some very simple calculations just to verify the model results. And there are several of these topics that are presented in the report, sort of scattered throughout there for you all to look at to help evaluate the uncertainty of the models. But there is no easy uncertainty index to really answer that question. And we have had as many demonstrations of uncertainty or certainty as possible within the report.

DR. SCHUBEL: Let's move on to the next one. It is really related. "Does uncertainty in predicting habitat cancel, and therefore allow use of models to gauge differences between alternatives?" "Does uncertainty in predicting habitat cancel, and therefore allow use of models to gauge differences between alternatives?" I am not quite sure what the -- but are the models capable of distinguishing the habitat changes among the different runway alternatives?

MR. CALLAWAY: I will start on that and I would say it depends on the scale that we are looking at for the difference between subtidal habitats, shifts between subtidal habitats and mudflats. I think it is probably relatively effective where we are talking about whether mudflats will completed erode out, or whether deep channels will fill in completely to mudflats. So I think in that sense we can look at differences between the alternatives based on the models, but if we are looking at fine scale changes like whether mudflats are going to shift from being upper intertidal mudflats that may be uncovered commonly on low tides to lower intertidal mudflats that are rarely uncovered, I do not think -- the models, the scale of the change is so small that would cause those shifts, and the models cannot really predict those changes individually for any of the alternatives. So I do not think in that sense that we can look at differences -- fine scale differences in habitat between the alternatives.

DR. SCHUBEL: Would anyone else like to add anything to that? Dave?

MR. SCHOELLHAMER: I would agree with John and just add that, for some of the large scale calculations, we did ask for some subsequent alternative calculations to demonstrate that taking the difference of the model results was giving reasonable results and the project team did that. And they did indicate that the results were reasonable for the large scale deposition in either the borrow pits or between the runways. But, again, as John mentioned, those small scale changes just cannot be resolved by the numerical models. And that is a limitation essentially of science and computing power that is a limitation on this project or others.

DR. SCHUBEL: Okay. "How valid is it to speak of average impact over the entire Bay as opposed to the actual impact on some areas of the Bay?" I wonder if someone from URS would like to address that briefly because you did look not just at average conditions, you looked at impacts in specific areas. Would one of you like to say a word about that? The question is, "How valid is it to speak of average impact over the entire Bay as opposed to the actual impact on some areas of the Bay?"

DR. FEHRING: I think our response would be, while we have used the average impact or average levels to create some scale, indications of scale, the data itself in the report does show specific changes at specific locations. But in order to put that in context for the reader, we commonly said that if you averaged it across, it would give you a level of scale. It is not the only way the data is reported.

DR. SCHUBEL: Go ahead, Fred?

MR. NICHOLS: One can consider an average impact vs. a specific impact. Probably the way to most easily address that is, if you have a resource that is threatened that is local in nature, then you have to be concerned about a local impact. But if you have, as we do, many of the species, fish, birds, wildlife, invertebrates that are widely distributed, the real question is what is the effect of a local perturbation on the average community? We know that where you build a runway, you are going to lose whatever was there. And we have said that, yeah, you are going to kill a clam when you cover him up with a runway, but the species will survive and do quite well. So you have to think of -- I have to think of -- "Am I going to affect the species population as a whole by any local impact?" And if the species is distributed everywhere, then a local impact is probably less relevant than the effect on the overall population.

DR. SCHUBEL: Diane.

MS. KOPEC: In relation to toxic contaminants, that is a very good question. It is important to realize that individual organisms are not exposed to the average level throughout the Bay, but to specific levels of toxic contaminants. And I would urge you to look at the more detailed information in the report on contaminant levels that these organisms will be exposed to.

DR. SCHUBEL: Yeah, there is an awful lot of data and information contained in this voluminous report, and there are CD's available with the entire report on it that I believe are here. Am I correct? Yes? There are, all right. So if anyone wants to have CD's of the entire report, they are available. This is another related question. "The long term effects analyses are all based on output from MIKE 21 model, which is most appropriate for modeling short term events or on a water season. I am concerned that this model provides an inappropriate basis for evaluation of effects that are decades or even centuries into the future. Jerry Galt, that is probably one for you. Okay, Dave. Are you still there, Dave?

MR. SCHOELLHAMER: Still thinking about that one. This is -- I think the concern is valid and it was certainly a concern of the panel, that not just the MIKE 21 issue explained as the hydrodynamic model, and then there were also sediment transport and contaminant models used, basically using the results from the MIKE 21 model, the hydrodynamic model, to drive those other models. This is a concern of the panel and therefore we asked, as I have mentioned previously, for certain tests, as best as could be done, at least with the geomorphology, to confirm the results and the conclusions within the report. And this is really a limitation of estuarian science, predicting these long term changes of projects or long term changes within an estuary. This is a tremendous challenge that probably nobody is doing extremely well because it is again, just a limitation of the science that we are all trying to overcome through research. But that is about essentially what we have here is as good as one can reasonably expect in terms of the geomorphology and the sediment transport, anyway, and for the long term predictions with existing technology. And this report and these results indicate, I think, where other research is needed.

DR. SCHUBEL: In these complex, time varying system, it is hard to predict these long term effects when freshwater input changes seasonally, annually, inter-annually, and if you look at the sea level here, it is probably going to rise by about three feet in the next 100 years, it makes it a little difficult to predict these long term changes. And I think, as Dave points out, the best you can do is look at some of the historical data that we have, bathimetric changes and so on, that you can get not just from bathimetric charts, but from the data that those charts were compiled from. And so, again, I think it goes back to the lines of evidence, the weight of evidence approach. Fred, you look like you want to say something? No.

MR. GALT: We might point out that if you do not build the runway, change will occur in our ability to predict three decades into the future on what that change will be without a runway is about the same if there was a runway.

DR. SCHUBEL: Okay. "The report contains a set of calculations that are intended to show that the fraction of habitat and species affected are small. These calculations use the entire Bay as their context and define the affected area as being limited to locations of direct physical effects. These calculations appear to greatly underestimate the impacts of the project. For example, the project would directly and indirectly affect a large fraction of the portions of the South Bay most heavily used by water fowl." So get ready, Janet, this one is for you. "Would the panel please comment on the appropriateness of these calculations and suggest a more appropriate context for such calculations?"

MS. HANSON: Would you repeat that?

DR. SCHUBEL: I will repeat the question -- fairly long. "The report contains a set of calculations that are intended to show that the fraction of the habitat and species affected is small. These calculations use the entire Bay as their context and define the affected area as being limited to locations of direct physical effects. These calculations appear to greatly underestimate the impacts of the project. For example, the project would directly and indirectly affect a large fraction of the portions of the South Bay most heavily used by water fowl. Would the panel please comment on the appropriateness of these calculations and suggest a more appropriate context for such calculations?"

MS. HANSON: Okay. I guess I am going to guess at which calculations, that the runways themselves would displace a certain fraction of the Bay's entire population of certain species, calculated on a spatial basis. And I think that is because the models are only able to tell us about the impacts directly at the near field which is the construction and operations site. They are not able to tell us so much about habitat change farther out and how that would affect percentages of species in the South Bay. So it is my understanding that there would be no change in open water habitat in the South Bay, and we are fairly certain about that, and that therefore there would not be an effect on the water fowl using open water habitat in the South Bay.

DR. SCHUBEL: Anybody else have anything to add? Are there other indirect effects from noise or anything that --

MS. HANSON: That is one thing that we cannot get at this point is the accumulation of effects. There is a look at contaminants separately, there is some look at noise, there is some look at disturbance, but how you add all that up is beyond us at this point.

DR. SCHUBEL: Yes, please.

MR. MARTIN: One of the things that we did was -- I think the question mentioned something about using the entire Bay. Most of the time what we were looking at is habitat just in the South Bay. Part of that was in response to earlier comments by the panel to put things into context, so when we are looking at the available habitat, that the birds or the fish --might put things into context. If some of these areas were critical habitat, if it was the only area that a species could use, that would have a far greater effect than if there are other areas around the Bay that these species could use, which is why we put it in the percentage context.

DR. SCHUBEL: This one I think is probably for Dave and John, so I will give you a heads up -- and maybe URS. "What will you predict will happen to the coastline south of the runway, Burlingame to Redwood City, if the runway expansion takes place?" Any ideas what will happen to the coastline south of the runway, Burlingame to Redwood City, if the expansion takes place? That is one for URS? Would any of you like to comment on that?

MR. ARMSTRONG: We did assess actually the issue of shoreline erosion south of the runways by both going out and doing field assessments and looking at those actual shorelines, as well as then taking those assessments and comparing it to some of the results of our other analyses. In many areas, we found that there were hardened shoreline areas, and by "hardened shoreline areas," I mean areas that were hardened by rock or other form. In some areas, we did see soft shorelines, and we did analysis to look at the erosion in the mudflats and how that would affect those shorelines and those results are in the report for your review.

DR. SCHUBEL: Now this one is quite a long one and I think it is a call for having not just this group of scientists review these reports, but a larger group. And I think, as in any good peer reviewed publication, it is available and we would encourage other scientists to review it and we are the initial filter. It is as if we were reviewing papers for a publication. And then the other point that I think is in here is that, if the airport expansion is pulled off the shelf and moved forward at some future date, how does the panel feel about updating the science that is available? So I guess I would like your comments on both of those -- in terms of having other scientists look at this report and evaluate it, and then what are your feelings about the need or the desirability for updating any of these data, this information, if the runway project were to go forward N years into the future? Fred?

MR. NICHOLS: Well, the first question, of course, to me is obvious. This should be reviewed by as many people who are interested. You know, it is critical to have a lot of people looking at -- this report has been building and evolving, and we have been party to it to this point, but, as we have said a number of times here, there are still studies that remain to be done -- critical critical studies that remain to be done. And we think that they should go on so that it is a complete report. But if in a few years this came off the shelf, you would certainly have to take whatever the finds were to date and there will be other studies done by other people in other contexts, and those will all have to be added in. This is not something that you will say is the crown jewel and will bring it out and just show it again. Science is an evolving process and, in two, to five, to seven years, there will be lots of new findings by other people, and it all has been incorporated.

DR. SCHUBEL: Camille would like to add a comment on it.

MS. GARIBALDI: In the context of doing a NEPA evaluation, which the Environmental Impact Statement is, if the Airport were to proposed a reconfiguration again in the near future, we would have to take this report, a complete look at the proposal that is coming forward again, make sure our analyses are up to date, and then we would proceed with conducting noise analysis, air quality analysis, a whole host of resource evaluations aimed at allowing us to get a draft Environmental Impact Statement out on the street that the public has an opportunity to review, that anybody that would be interested in is welcome to comment on and help us from that point to take it into a final product. So it depends on when and it depends on what it is, but I can assure you we would be taking a look at this resource, this technical study, and looking at what would need to be updated so that we could then fully evaluate whatever is proposed, whenever it is proposed.

DR. SCHUBEL: While you are there, let me read another question that is for you. You said the EIS work has stopped. Some have said that stoppage of the study will forfeit some of the research. Can you comment on what will be lost or ruled invalid if the EIS is not carried through, how long will current work last?

MS. GARIBALDI: Typically we re-evaluate that on a three-year basis. What I think the context of the science that would be lost is some of the team that has been put together to do this analysis. Right now we will not be proceeding with this Environmental Impact Statement. There would be a selection process for a new consultant team, and so we would lose -- the context is the team that has done some of the analyses may not be the team that helps us put together the next Environmental Impact Statement should there be one. But that is a prediction that is hard to make. It depends on what happens in the future.

DR. SCHUBEL: Okay, thank you. And the previous question. Anybody else want to add to that in terms of the need for additional studies if this goes forward? Diane and then John.

MS. KOPEC: Yeah. Just to reinforce the statement Camille just made, because the EIS was not completed, we did not have the full set of information needed to predict the effects of the proposed construction on wildlife, especially in my area of study on harbor seals. With that information on noise impacts, with that information on cumulative effects from other construction activities in the Bay, without more detailed information on changes in habitat, and without confirming the predicted levels of bioaccumulation of toxic contaminants, more information is needed before we can make a definitive prediction on what is going to happen, so certainly that would need to be addressed if the Airports moves forward.

DR. SCHUBEL: John?

MR. CALLAWAY: I was just going to point out that in our written evaluation, we will be providing recommendations for where new information is needed, and so if the project is resumed there will be an opportunity for them -- that time period will be an opportunity for it.

DR. SCHUBEL: One product of any good research project, it indicates where further research is appropriate, and this one is no exception. I am going to read a statement and then if anybody wants to react to it -- it is not really a question, but -- "I am concerned that the South Bay ecosystem would be blocked by the disturbance line across the Bay, including the Airport site pipeline from the borrow site, and by the borrow site itself." So it is a concern that the South Bay ecosystem will be blocked by this disturbance across by both, I guess, the physical disturbance, the sound barrier, all kinds of activity. Anybody want to -- it is a concern, it is not really a question, but if anybody would like to respond, that would be fine. Fred?

MR. NICHOLS: Perhaps URS ought to describe how -- briefly what will happen by getting the stuff from one side of the Bay to the other because that is probably critical to the question.

DR. SCHUBEL: Yes, okay.

MR. SCHOELLHAMER: If, uh, a lot of the assumption was that for the transfer of the material from the East Bay site over to the Airport platform would be done with a hydrologic dredge, and in that instance, you would bury a pipeline across the Bay and it would be buried in the sediment deep enough, generally particularly across the channel where it would not interfere with navigation. But normally a dredge pipeline is floating at the very beginning where it works with the dredge, and then drops to the bottom. So it can be submerged as it comes across and there is not really a major impediment to it. If you are in the process, of course, of using hoppers and barges, clamshells and barges, then you are going to have a string of traffic back and forth, but again, it is intermittent. These things are not a continuous train back and forth. The system is just not that efficient.

DR. SCHUBEL: Anybody else want to add anything to that? Okay, let me read this one and if anyone wants to respond, fine. "In conclusion, would the Bay's ecosystem be better off without these new runways?" That gets right to the point. I do not believe it is a scientific question, however, and I think it belongs in the public decision-making process where science can tell you what the effects will be near term, in short term, and with some greater uncertainty as we project out, but there are many other factors. So I think that is not a question that any of us could or should answer. I would be happy to have someone prove me wrong. All right, "Regarding the scientific study, what happens next? What is the timing?" And I think that means our report. And, "Will the NOAA Panel disband?" I certainly hope so! No, no, we have had a very good relationship and, like any good family, at times we were dysfunctional because of arguments, but all in all, this was a very good relationship. And David McKinnie, why don't you say a word about what comes next?

MR. McKINNIE: Okay, what is next is that Dr. Schubel and I have a lot of work to do and we have to compile sort of the history of the panel in a way, and we have committed to the Bay community to do that, so you could see, we asked to operate out of the public eye for, well, actually up until now. But in exchange for that, we explained to you that we would let you know what happened, and so our interim comments back and forth will be essentially a record of how we interacted with the consultants, the FAA, and SFO, and that will be available to you as part of the final report. In addition, there is material we have written, the panels have written, that we will compile and organize, that we hope will be helpful in interpreting these reports and other reports that are done in the future. And then, finally, well, two other sections. One is, of course, our assessment of the final report and, then, John mentioned some suggestions for additional research. So over the next month, Dr. Schubel and I will be working on that, and then the Panel will scrub it as they always do, and we will have continued discussions on e-mail and in person, and then publish our final report as soon as possible. I am not going to give you a date. We will definitely get it out this summer, but if I told you a date certain, we might not hit it, actually. So that is the plan. And then, once our final report is on the street, the Panel is disbanded and they go off and do all the other interesting things they were doing before.

DR. SCHUBEL: Okay, let me make a few closing observations, if I could read back notes I have been writing here. We are ahead of schedule. First of all, I would like to thank the Panel. We are missing, I guess, five or six. And in the aggregate, this Panel has put in many many hundreds of hours on this project. The peer review process was a good one and I think with only minor changes, it could serve as a model for other projects that are proposed for San Francisco Bay and for other Coastal areas. I repeat that the one overriding recommendation that we would have is that you need to engage the panel at the outset to get maximum benefit. Do it during the planning phase before any field sampling has been done. URS and the body of work has contributed to our understanding of the Bay and they have provided tools to evaluate perturbations to the Bay. The value of these contributions should neither be under estimated nor ignored. This should not be dismissed as just another consultant's report. It is a major contribution to our understanding of this system, and integrating a lot of disparate data and information. The science that was done is good, that is, it is appropriate. It has been improved and has survived a peer review process by this panel, and this was a pretty rigorous process, I think, with a fairly demanding panel. The evaluation of impacts is complex and it is still evolving, and there are questions that need to be addressed before in the EIR/EIS. And the questions that we have refer most -- not to what has been done, but what remains to be done. There always is going to be more research, there always will be more questions to answer, particularly in a highly variable complex environmental system like San Francisco Bay where the natural forcing functions are changing -- river input, sea level, and so on. And this study and the Panel have suggested areas for further investigation. The science is going to be most helpful in the context of what people in this region want the Bay to be like in the future and how they want it to be like as a place to live within this region. Once you know that, science can help you achieve that vision. Science really is a tool. And the best statement I have ever heard came from Leo Tolstoy who said, "Science does not tell us how to live, it has nothing to contribute on moral grounds." David has given you the rough outline of how we are going to proceed from here. Our final report, in addition to a compilation of all of the comments that we made and all of the responses to those from URS will include a summary statement of our conclusions, and it will also have a set of areas of recommended research. So I guess to all of you in the audience, stay involved, it is your Bay. This has been a good process. Thank you.

[Adjourned.]