National Oceanic and Atmospheric Administration

Office of Oceanic and Atmospheric Research

Earth System Research Laboratory
Chemical Sciences Division
Science Review
March 30-April 1, 2015

Guidelines for Review Panel Members

January 2015

1. Introduction

Laboratory science reviews are conducted every five years to evaluate the **quality**, **relevance**, and **performance** of research conducted in Oceanic and Atmospheric Research (OAR) laboratories. This review is for both internal OAR/NOAA use for planning, programming, and budgeting, and external interests. It helps the Laboratory in its strategic planning of its future science. These reviews are also intended to ensure that OAR laboratory research is linked to the National Oceanic and Atmospheric Administration (NOAA) Strategic Plan, is relevant to NOAA Research mission and priorities, is of high quality as judged by preeminence criteria, and is carried out with a high level of performance.

These guidelines have been prepared using experience gained from previous laboratory reviews. The goal of the guidelines is to clarify your role and assist in the organization of the work of the review panel. The guidelines cover the process from when you receive the invitation letter to participate on the review panel to submission of the summary report of the review panel.

2. Research Areas in Review and Charge to the Review Panel

Each member of the review panel should have received the "charge to the reviewers" document. The charge covers the following topics: purpose of the review, scope of the review, research areas for the review, evaluation guidelines including questions to be addressed by the review panel, proposed schedule including the dates of the review, time frame for delivery of the final review report as well as the time commitment for reviewers, and review panel resources. Each member is asked to complete a review report (using an Evaluation Worksheet, Appendix C) so that each research area will be reviewed by at least two panel members; members will provide those reviews to the Chair. The Chair will summarize the recommendations and ratings of individual reports of the review panel, but will not attempt to seek a consensus of the review panel on any findings or recommendations. Each member of the review panel received a conflict of interest disclosure form; thanks for returning the completed form. A description of the Laboratory's research areas is in Appendix A.

3. Resources for the Review Panel

Steven Fine, Deputy Assistant Administrator (DAA) of OAR for Laboratories and Cooperative Institutes, will provide the resources necessary for you and the review panel to complete its work. A list of OAR contacts for the review is in Appendix D. All Laboratory review materials and presentations for the review will be posted to a website in advance of the review. The web site will contain background documents from NOAA (e.g., NOAA Strategic Plan, NOAA Research 5-Year Plan); background data on the Laboratory, including several "indicators of preeminence" (e.g., publications, awards, scientific leadership, patents); and presentation files. Please let us know if you would like to receive a binder with printed copies of presentations in advance of the review. You are also provided a template (form) on which to complete your review observations,

findings, and recommendations and to provide your overall evaluation of the research areas (Appendix C).

4. Logistics and Agenda for the Review

Travel arrangements for the onsite review will be made and paid for by OAR. Laboratory staff will contact you to arrange travel to the review. If you have not already done so, please provide the Laboratory travel coordinator (listed in Appendix D) with your intended dates of travel and other particulars by the requested due dates to ensure all arrangements are made satisfactorily. The laboratory will reserve a block of hotel rooms for the reviewers, but you will be asked to cover all your travel expenses (except air fare) upfront and will be reimbursed, usually through direct deposit to your bank, after laboratory staff complete the travel reimbursement forms with your help. Some receipts may be needed for reimbursement. If you have not been the recipient of federal travel reimbursement before, you will need to register as a U.S. government vendor to receive your travel reimbursement. The Laboratory travel staff will do that for you, but you will have to provide them with some personal identifying information, including the routing and account numbers for your bank account for direct deposit of the reimbursement. For non-U.S. reviewers, you will be sent a check for travel cost reimbursement. Travel schedules should be chosen to allow you to attend all scheduled review sessions.

Laboratory staff may also ask for information for building security in advance of the review, particularly for reviewers who are not U.S. citizens. In any case, bring photo identification.

5. Teleconferences Prior to the Review

Two teleconferences will be scheduled to discuss the review process and answer any questions you may have. The first of these teleconferences will occur approximately two months prior to the review, and the second will occur approximately two weeks prior to the review. In addition to the review panel members, attendees will include the OAR Deputy Assistant Administrator (DAA), the OAR Headquarters coordinator, and management from the Laboratory. On the first call, the charge to the review panel and the draft agenda for the review will be discussed as well as any other questions reviewers may have on the process or on the preliminary materials on the website. The second call will cover information provided on the website, presentation materials, the final review agenda, the review reports, and resolution of last-minute details. During this call, we ask that you identify any additional information needs. All relevant information requested by the review panel will be provided on the review website at least two weeks before the review and prior to the second teleconference with the review panel.

6. During the Review

Reviews are held over a three-day period. On the morning of the first day, you will meet at breakfast with the OAR Assistant Administrator (AA) and DAA to discuss any final issues before the review. Generally the first morning will include an overview presented by the Laboratory director and other senior management staff. The review agenda includes presentations and discussions that will provide information on the research areas to be reviewed and the questions to be addressed by the review panel. These presentations may include PowerPoint presentations, poster sessions, demonstrations, and/or facility tours. Time will be built into the review schedules for questions and discussion following presentations. Interactive dialogue and discussion during all of the sessions is strongly encouraged.

As time permits, reviewers will meet in closed sessions with Laboratory management, as well as with laboratory scientists, visiting scientists, and/or Post Docs, without management present. A separate session has been arranged for teleconference discussions with the Laboratory's key stakeholders. While you will receive answers to questions provided in advance, this is an opportunity to get input about the Laboratory's science, products and services from key customers. Please use these closed sessions to probe more deeply into the science and operations of the Laboratory.

Time will also be set aside for reviewers-only, closed sessions. The goals of the reviewers-only sessions are to provide time for the review panel to discuss any presentations or information provided and to identify additional information needed or issues that need to be clarified. The closed sessions also provide an opportunity to work on the individual evaluations and to prepare for the preliminary report to laboratory management at the end of the third day. At any time during the review, you should feel free to request additional information or clarifications from Laboratory staff.

7. Preparation and Submission of the Review Report

We ask that you complete your individual reports providing a rating - Highest Performance, Exceeds Expectations, Satisfactory or Needs Improvement - as outlined on the form. The evaluation guidelines (Appendix B) provide a description of what constitutes these ratings and evaluation questions to consider in providing a rating. For the convenience of the panel, a fillable Evaluation Worksheet is provided in Appendix C for entry of findings and recommendations for each research area assessed as well as the overall rating discussed above. We ask that, based on your findings, you provide recommendations that are specific and actionable by the laboratory. The Chair will compile a final summary report from the individual reports. In order to be compliant with the Federal Advisory Committee Act, the Chair is asked not to seek consensus, but to summarize or otherwise combine the individual evaluations.

We suggest that the final summary report include the following elements:

- ✓ **Cover Page**
  Please include a title page with the title, *Summary Report of the Review of the NOAA Earth System Research Laboratory Chemical Sciences Division*, the date of the review, and the names of the reviewers and their organizational affiliations.

- ✓ **Overview Section**
  Please include details of the location and date of review and the research areas covered in the report. Please include a statement that the report is not a consensus, but a summary of individual reviewer reports.

- ✓ **Summary of Laboratory-Wide Findings and Recommendations**
  Include in this section an overall rating for the entire Laboratory, and findings and recommendations relevant to the entire Laboratory. These could include points that arose in multiple Research Areas, during the presentations, discussions, lab tours, or other aspects of the review agenda, or in discussions during the work sessions of the review panel.

  Also include a listing/table that summarizes each reviewer's overall evaluation rating (Highest Performance, Exceeds Expectations, Satisfactory, Needs Improvement) for each research area he/she reviewed, and, if possible, also ratings for the subcategories of Quality, Relevance, and Performance. It is helpful for the Laboratory to understand the findings and recommendations, and that the recommendations are worded so they are actionable.

- ✓ **Findings and Recommendations by Research Area**
  Include findings and recommendations for each research area, and include the overall rating for each research area (Highest Performance, Exceeds Expectations, Satisfactory, Needs Improvement). For ratings of "needs improvements" please suggest specific actions the Laboratory could to take to make improvements.

- ✓ **Summary of Recommendations**
  Please include a numbered list of all recommendations in your report.

The final report is requested within **45 days** of the review and should be submitted by the Review Panel Chair to the DAA and the Laboratories and Cooperative Institutes (LCI) Coordinator (Appendix D). Once the report is received, OAR staff will have **30 days** to review the report, identify any factual errors or necessary clarifications, and send the technical corrections to the review panel. The review panel will consider the suggested technical corrections and deliver the final report and individual evaluations (separate files) within **30 days** to the OAR Assistant Administrator with a copy to the LCI.

8. Uses for and Distribution of the Review Report

As outlined in the "purpose of the review" section of the "charge to reviewers," Laboratory scientific reviews are conducted to help the Laboratory in its strategic planning of its future science, and to ensure that Laboratory research is linked to the NOAA Strategic Plan, is relevant to OAR mission and priorities, is of high quality as judged by preeminence criteria, and is carried out with a high level of performance. After submission of the final report by the review panel, the Laboratory will be asked to review the report and prepare a plan, to be discussed with OAR management, to incorporate recommendations into Laboratory research and operations.

The final report will be a standalone, public document and may be distributed to internal NOAA and external audiences. Your individual reports will not be made public, and will only be used by OAR as background for the final report. Internal distribution of the individual reports will be limited.

9. Schedule and Time Commitment for Reviewers

The on-site review will be conducted over a three-day period, March 30-April 1, 2015, at the Earth System Research Laboratory in Boulder, Colorado. Two teleconferences are planned with the Deputy Assistant Administrator for OAR in advance of the review (~two months prior and ~2 weeks prior).

Each reviewer is asked to independently prepare his or her written evaluation on each of the research areas assigned to them and provide these to the Chair. The Chair will draft the final report summarizing the individual evaluations and transmit it to the Deputy Assistant Administrator and the OAR HQ LCI Coordinator (see Appendix D) within 45 days of completion of the review. Once the report is received, OAR staff will have 30 days to review the report, identify any factual errors or necessary clarifications, and send the technical corrections to the review panel. The review panel will consider the suggested technical corrections and deliver the final report and individual evaluations (separate files) within 30 days to the Assistant Administrator, OAR, with a copy to the LCI.

Appendix A

Description of Research Areas for the Review

Mission Statement and Vision of the Chemical Sciences Division (CSD)
The Chemical Sciences Division (CSD) of ESRL is committed to the discovery, understanding, and quantification of the processes that govern the chemical composition of Earth's atmosphere and to improving NOAA's capability to predict their behavior. The goal of Chemical Sciences Division research is to understand and quantify the chemical processes responsible for changes and transformations in the atmosphere related to climate (including the stratosphere), air quality, and the interconnections among them. Meteorological, dynamical, and radiative phenomena are also investigated when needed to understand the chemical processes.

Core Competencies

- The development of scientific understanding of the chemical and physical processes that influence the chemical composition of Earth's atmosphere.
- The performance of laboratory studies (1) to characterize key chemical reactions that impact the composition of the atmosphere; (2) to quantify fundamental photolytic, kinetic, and thermodynamic parameters for use in predictive models; and (3) to evaluate industry-proposed substitute compounds (e.g., solvents, refrigerants) for impacts on climate, air quality, and the stratosphere.
- The execution of intensive field campaigns involving the coordinated deployment of highly instrumented surface sites and instrumented mobile platforms (manned and unmanned research aircraft and ships) to characterize and quantify atmospheric processes that influence the concentrations and distributions of atmospheric chemical components.
- The development and evaluation of state-of-the-art sensors to accurately and reliably quantify atmospheric levels of key chemical species including sensors that are capable of operating autonomously on research aircraft from the lower atmosphere up to the stratosphere.
- The development and application of predictive computer models that faithfully simulate atmospheric chemical and physical processes for use in assessing impacts of specific emissions and emission sectors on Earth's climate, air quality, and stratospheric ozone layer.
- Leadership of and contribution to national and international state-of-scientific understanding assessments for decision support on the topics of climate, air quality, and the ozone layer.

Key Products

- Peer-reviewed publications – The scientific breakthroughs produced by CSD research are documented in groundbreaking peer-reviewed publications.
- Improved sensor technology – State-of-the-art instrumentation is developed for the accurate and reliable quantification of key atmospheric constituents.

- National and international assessments – CSD scientists play leadership roles and CSD science is featured prominently in national and international assessments that are specifically designed to inform regional, national, and international policy development on the most pressing environmental issues that face us today.
- Scientific synthesis documents - CSD scientists provide to stakeholders and customers clear scientific summaries of the results from intensive field studies that provide the information needed to make informed decisions concerning local and regional air quality and climate issues.

Connection to the Mission of NOAA
As defined in its Next Generation Strategic Plan (NGSP), NOAA's mission, in part, is "to understand and predict changes in climate, weather, oceans, and coasts, and to share that knowledge and information with others." The research conducted by CSD plays central roles in both of these aspects of NOAA's mission. CSD scientists develop and deploy state-of-the-art instruments in laboratory and field environments where measurements probe the boundaries of current scientific understanding of atmospheric chemistry and push that understanding forward. Careful analyses and computer modeling provide insights into the atmospheric phenomena under study, leading to improved understanding and predictions. Results are communicated not only to the scientific community, but also to the regulatory and policy communities in documents that are clear and understandable. Further, CSD scientists take lead roles in evaluating current understanding of important environmental issues by authoring and reviewing international assessments.

In the language of the NGSP, CSD research contributes directly to the Climate Mitigation and Adaptation strategic goal via the objectives of Improved Scientific Understanding, Assessments that Identify Impacts and Inform Decisions, and Mitigation and Adaptation Choices. Within the Weather-Ready Nation strategic goal, CSD research contributes to the Healthy People and Communities objective. All of CSD research contributes to the Science and Technology Enterprise objective via the Holistic Understanding of the Earth System sub-objective.

Research Areas for Review

1. **Climate Research (Including Stratospheric Research)**
2. **Air Quality Research**
3. **Connections: Climate, Air Quality, and the Stratosphere**

1. Climate Research (Including Stratospheric Research)
Objective: Improved predictive capability through a better understanding of the connections between emissions, atmospheric composition, and Earth's climate system.
CSD Climate Research is focused on (1) short-lived climate pollutants (SLCPs); and (2) addressing water vapor and aerosols (airborne fine particles) — two of the greatest uncertainties in current climate models. This is done through understanding and quantifying various chemical and dynamical processes that influence climate.

Short-lived climate pollutants (SLCPs) include methane, tropospheric ozone, aerosols

(including black carbon), and substitutes for ozone-depleting substances (including hydrofluorocarbons, HFCs). They contribute directly to climate forcing, are key to many climate feedbacks, link climate change and air quality, and are areas of current focus for policy formulation. The IPCC has identified the role of atmospheric aerosols in climate change as the single greatest uncertainty in our ability to predict changes to the climate system. This role includes physical and chemical processes by which aerosols influence clouds, as well as various cloud properties.

Research at CSD is addressing key uncertainties related to: (1) tropospheric ozone, (2) aerosols (both absorbing, e.g., black carbon, that warm the Earth's atmosphere and scattering, e.g., sulfate aerosols, that cool the surface), (3) emissions of chemically active greenhouse gases such as methane and nitrous oxide, and (4) quantifying the influence of aerosols on cloud formation, extent, and optical properties (Earth's radiation balance) as well as on precipitation. This research integrates laboratory, field, and modeling work to understand processes related to chemistry and transport. Central to this work is the development of instruments that are sensitive and selective for "difficult-to-measure," but important, atmospheric gases and particles. A particular focus is on quantification of emissions of precursors for ozone and aerosols, as well as of key chemically active greenhouse gases, such as nitrous oxide and methane.

The water vapor abundance in the upper troposphere and lower stratosphere (UT/LS) is a critical factor in determining the amount of radiation lost to space and thus determining the energy budget of Earth's surface. Water vapor in this region, though, is particularly difficult to quantify. A better quantification of water vapor and its distribution in this part of the atmosphere is needed to properly account for past changes in the Earth's climate and reliably predict/project future changes. Work is underway in CSD to improve the measurement of water vapor in the UT/LS and enhance the understanding of its atmospheric distribution.

CSD makes ongoing contributions to (1) advancing scientific knowledge regarding the processes involved in ozone-layer depletion by chlorofluorocarbons and other compounds, (2) assessments of the state of knowledge regarding stratospheric ozone, and (3) communication of that information to policymakers in formats that are useful to their decision-making process. CSD is a lead participant in scientific state-of-understanding assessment reports for decision-makers, and has been since the inception of the United Nations Montreal Protocol, the 1987 international agreement that protects the ozone layer. U.S. policy makers, the U.S. chemical industry, EPA, and other national and international agencies rely on these scientific assessments as a basis for their development of scientifically sound, well-informed policies.

2. Air Quality Research

Objective: Provide sound science to support informed air-quality decision-making at national, state, and local levels.

Air quality research on (i) improving understanding of the processes responsible for poor air quality, i.e., surface ozone and particulate matter suspended in air (PM, also referred to as aerosols), and (ii) enhancing predictive capability is essential for air quality

management and forecast applications. There is also a strong demand for working with stakeholders to identify their needs up front, and then communicating research results to air quality decision-makers in a timely, user-friendly manner.

Many atmospheric constituents, both natural and manmade, interact to affect surface ozone and PM levels. In addition, the factors that influence air quality differ at the regional scale across the U.S. CSD research is focused on key regions of the U.S. that are impacted by poor air quality. The aim of the research is to understand the sources of these constituents and the nature of their interactions, in order to provide a basis for determining how to mitigate the problem of surface ozone and PM pollution. CSD scientists also focus on understanding the precursors, chemical processes, and boundary layer meteorology that influence the formation of atmospheric aerosols. As air quality regulatory standards tighten, regional to intercontinental transport of pollution, as well as stratospheric intrusions of ozone, become critical issues for attainment of those standards. Moreover, national policy, such as the quest for energy independence via oil and natural gas development, can have a significant impact on regional and local air quality issues. CSD research is addressing these emerging air quality issues through laboratory studies, instrument development activities, biennial intensive field studies coupled with model analysis, and providing the information to users.

3. Connections: Climate, Air Quality, and the Stratosphere
Objective: Linking emissions to impacts – climate and air quality.
The three major environmental issues of climate change, air quality, and stratospheric changes are interlinked in science and in policy. Research is needed to advance scientific understanding at the intersections of these issues.

The interplay between air quality and climate change with regard to the short-lived climate pollutants (SLCPs) is a major research theme. Emissions of SLCPs and their precursors are one of the most uncertain components in understanding, attributing, and predicting climate change and its interactions with other impacts, in particular air quality. A key example is tropospheric ozone. Emissions from anthropogenic activities have made ozone a regional air quality problem, but increases in tropospheric ozone have also exacerbated climate forcing. Many air quality regulatory actions are already codified and their implementation will have impacts on climate—some negative, some positive, and some neutral. One of the main issues in climate change mitigation efforts is to manage emissions (one of the few knobs a society can turn!) for the benefit of multiple issues, but also to avoid unintended consequences. For example, current agricultural practices require intensive application of nitrogen-based fertilizers to increase crop yields. This has the potential to affect (1) air quality through soil emissions of nitrogen oxides (NO_x), (2) climate change via soil emission of the potent greenhouse gas nitrous oxide (N_2O), and (3) stratospheric ozone, again via soil emission of N_2O.

There is evidence that stratospheric changes affect climate or might be affected by climate. The connection between the recovery of the stratospheric ozone layer and climate is a prime example. Other examples include connections between stratospheric

water vapor and surface temperature changes, and changes in stratospheric circulation that influence, and are influenced by, climate change.

CSD is working to provide scientific information that helps identify options for air quality management that will also benefit climate change mitigation and for climate policy issues that influence air quality. Similarly, CSD also addresses issues such as the role of stratospheric intrusions on surface ozone, role of transport from other continents on surface ozone, etc. A major example of how CSD implements this research is our field missions, augmented by laboratory studies and modeling analyses, which are designed to address both air quality and climate objectives. The thrust is to provide science-based information to decision-makers. CSD achieves these objectives through research and communicating the information in a usable form to decision-makers.

Appendix B

OAR Laboratory Reviews
Evaluation Guidelines

Purpose of the Review: Laboratory science reviews are conducted every five years to evaluate the **quality**, **relevance**, and **performance** of research conducted in Oceanic and Atmospheric Research (OAR) laboratories. This review is for both internal OAR/NOAA use for planning, programming, and budgeting, and external interests. It helps the Laboratory in its strategic planning of its future science. These reviews are also intended to ensure that OAR laboratory research is linked to the National Oceanic and Atmospheric Administration (NOAA) Strategic Plan, is relevant to NOAA Research mission and priorities, is of high quality as judged by preeminence criteria, and is carried out with a high level of performance.

Each reviewer will independently prepare their written evaluations so that all research areas have at least two reviews. The Chair will create a report summarizing the individual evaluations. The Chair will not analyze individual comments or seek a consensus of the reviewers.

Evaluation Guidelines

For each research area reviewed, each reviewer will provide one of the following overall ratings:

- *Highest Performance*--Laboratory greatly exceeds the Satisfactory level and is outstanding in almost all areas.
- *Exceeds Expectations*--Laboratory goes well beyond the Satisfactory level and is outstanding in many areas.
- *Satisfactory*--Laboratory meets expectations and the criteria for a Satisfactory rating.
- *Needs Improvement*--Laboratory does not reach expectations and does not meet the criteria for a Satisfactory rating. The reviewer will identify specific problem areas that need to be addressed.

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Reviewers are to consider the Quality, Relevance, and Performance of the laboratory, and to provide one of the overall ratings above for each research area reviewed. We also ask that, in addition to the overall ratings for each research area, if possible also assign one of these ratings for the subcategories of Quality, Relevance, and Performance within the research area reviewed. Ratings are relative to the Satisfactory definitions shown below.

1. **Quality:** Evaluate the quality of the Laboratory's research and development. Assess whether appropriate approaches are in place to ensure that high quality work will be performed in the future. Assess progress toward meeting OAR's goal to conduct preeminent research as listed in the "Indicators of Preeminence."

- **Quality Rating Criteria:**
  - *Satisfactory* rating -- Laboratory scientists and leadership are often recognized for excellence through collaborations, research accomplishments, and national and international leadership positions. While good work is done, Laboratory scientists are not usually recognized for leadership in their fields.

- **Evaluation Questions to consider:**
  - Does the Laboratory conduct preeminent research? Are the scientific products and/or technological advancements meritorious and significant contributions to the scientific community?
  - How does the quality of the Laboratory's research and development rank among Research and Development (R&D) programs in other U.S. federal agencies? Other science agencies/institutions?
  - Are appropriate approaches in place to ensure that high quality work will be done in the future?
  - Do Laboratory researchers demonstrate scientific leadership and excellence in their respective fields (e.g., through collaborations, research accomplishments, externally funded grants, awards, membership and fellowship in societies)?

- **Indicators of Quality:** Indicators can include, but not be limited to the following (note: not all may be relevant to each Laboratory)
  - A Laboratory's total number of refereed publications per unit time and/or per scientific Full Time Equivalent scientific staff (FTE).
  - A list of technologies (e.g. observing systems, information technology, numerical modeling algorithms) transferred to operations/application and an assessment of their significance/impact on operations.
  - The number of citations for a lab's scientific staff by individual or some aggregate.
  - A list of awards won by groups and individuals for research, development, and/or application.
  - Elected positions on boards or executive level offices in prestigious organizations (e.g., the National Academy of Sciences, National Academy of Engineering, or fellowship in the American Meteorological Society, American Geophysical Union or the American Association for the Advancement of Science etc.).
  - Service of individuals in technical and scientific societies such as journal editorships, service on U.S. interagency groups, service of individuals on

boards and committees of international research-coordination organizations.

- A measure (often in the form of an index) that represents the value of either individual scientist or the Laboratory's integrated contribution of refereed publications to the advancement of knowledge (e.g., Hirsch Index).
- Evidence of collaboration with other national and international research groups, both inside and outside of NOAA including Cooperative Institutes and universities, as well as reimbursable support from non-NOAA sponsors.
- Significance and impact of involvement with patents, invention disclosures, Cooperative Research and Development Agreements and other activities with industry.
- Other forms of recognition from NOAA information customers such as decision-makers in government, private industry, the media, education communities, and the public.
- Contributions of data to national and international research, databases, and programs, and involvement in international quality-control activities to ensure accuracy, precision, inter-comparability, and accessibility of global data sets.

2. **Relevance**: Evaluate the degree to which the research and development is relevant to NOAA's mission and of value to the Nation.

   ➢ **Relevance Rating Criteria:**

   - *Satisfactory* rating -- The R&D enterprise of the Laboratory shows linkages to NOAA's mission, Strategic Plan, and Research Plan, and is of value to the Nation. There are some efforts to work with customer needs but these are not consistent throughout the research area.

   ➢ **Evaluation Questions to consider:**

   - Does the research address existing (or future) societally relevant needs (national and international)?
   - How well does it address issues identified in the NOAA strategic plan and research plans or other policy or guiding documents?
   - Are customers engaged to ensure relevance of the research? How does the Laboratory foster an environmentally literate society and the future environmental workforce? What is the quality of outreach and education programming and products?

- Are there R&D topics relevant to national needs that the Laboratory should be pursuing but is not? Are there R&D topics in NOAA and OAR plans that the Laboratory should be pursuing but is not?

➢ **Indicators of Relevance:** Indicators can include, but not be limited to the following (note: not all may be relevant to each Laboratory)
- Results of written customer survey and interviews
- A list of research products, information and services, models and model simulations, and an assessment of their impact by end users, including participation or leadership in national and international state-of-science assessments.

3. **Performance**: Evaluate the overall effectiveness with which the Laboratory plans and conducts its research and development, given the resources provided, to meet NOAA Strategic Plan objectives and the needs of the Nation. The evaluation will be conducted within the context of three sub-categories: **a) Research Leadership and Planning, b) Efficiency and Effectiveness, c) Transition of Research to Applications (when applicable and/or appropriate)**.

➢ **Performance Rating Criteria:**
- *Satisfactory* rating --
  - The Laboratory generally has documented scientific objectives and strategies through strategic and implementation plans (e.g., Annual Operating Plan) and a process for evaluating and prioritizing activities.
  - The Laboratory management generally functions as a team and works to improve the operation of the Laboratory.
  - The Laboratory usually demonstrates effectiveness in completing its established objectives, milestones, and products.
  - The Laboratory often works to increase efficiency (e.g., through leveraging partnerships).
  - The Laboratory is generally effective and efficient in delivering most of its products/outputs to applications, operations or users.

A. Research Leadership and Planning: Assess whether the Laboratory has clearly defined objectives, scope, and methodologies for its key projects.

- **Evaluation Questions to consider:**
  - Does the Laboratory have clearly defined and documented scientific objectives, rationale and methodologies for key projects?
  - Does the Laboratory have an evaluation process for projects: selecting/continuing those projects with consistently high marks for merit, application, and priority fit; ending projects; or transitioning projects?
  - Does the laboratory have the leadership and flexibility (i.e., time and resources) to respond to unanticipated events or opportunities that require new research and development activities?
  - Does the Laboratory provide effective scientific leadership to and interaction with NOAA and the external community on issues within its purview?
  - Does Laboratory management function as a team and strive to improve operations? Are there institutional, managerial, resource, or other barriers to the team working effectively?
  - Has the Laboratory effectively responded to and/or implemented recommendations from previous science reviews?

- **Indicators of Leadership and Planning:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).
  a. Laboratory Strategic Plan
  b. Program/Project Implementation Plans.
  c. Active involvement in NOAA planning and budgeting process.
  d. Final report of implementation of recommendations from previous Laboratory review.

B. Efficiency and Effectiveness: Assess the efficiency and effectiveness of the Laboratory's research and development, given the Laboratory's goals, resources, and constraints and how effective the Laboratory is in obtaining needed resources through NOAA and other sources.

- **Evaluation Questions to consider:**
  - Does the Laboratory execute its research in an efficient and effective manner given the Laboratory goals, resources, and constraints?
  - Is the Laboratory organized and managed to optimize the conduct and planning of research, including the support of creativity? How well integrated is the work with NOAA's and OAR's planning and execution activities? Are there adequate inputs to NOAA's and OAR's planning and budgeting processes?

- Is the proportion of the external funding appropriate relative to its NOAA base funding?
- Is the Laboratory leveraging relationships with internal and external collaborators and stakeholders to maximize research outputs?
- Are human resources adequate to meet current and future needs? Is the Laboratory organized and managed to ensure diversity in its workforce? Does the Laboratory provide professional development opportunities for staff?
- Are appropriate resources and support services available? Are investments being made in the right places?
- Is infrastructure sufficient to support high quality research and development?
- Are projects on track and meeting appropriate milestones and targets? What processes does management employ to monitor the execution of projects?

➢ **Indicators of Efficiency and Effectiveness:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).

a. List of active collaborations
b. Funding breakout by source
c. Lab demographics

C. Transition of Research to Applications: How well has the Laboratory delivered products and communicated the results of their research? Evaluate the Laboratory's effectiveness in transitioning and/or disseminating its research and development into applications (operations and/or information services).

➢ **Evaluation Questions to consider:**

- How well is the transition of research to applications and/or dissemination of knowledge planned and executed?
- Are end users of the research and development involved in the planning and delivery of applications and/or information services? Are they satisfied?
- Are the research results communicated to stakeholders and the public?

➢ **Indicators of Transition:** Indicators can include, but not be limited to, the following (Note: Not all may be relevant to each Laboratory).

a. A list of technologies (e.g. observing systems, information technology, numerical modeling algorithms) transferred to operations/application and an assessment of their significance/impact on operations/applications.
b. Significance and impact of involvement with patents, Cooperative Research and Development Agreements (CRADAs) and other activities with industry, other sectors, etc.
c. Discussions or documentation from Laboratory stakeholders

Appendix C: Evaluation Worksheets
(Note in WORD the boxes below will expand to fit the text)

Evaluation Worksheet 1

Research Area: Climate Research (including Stratospheric Research)
Reviewer: **Overall Evaluation:** ☐ *Highest Performance*--Laboratory greatly exceeds the Satisfactory level and is outstanding in almost all areas. ☐ *Exceeds Expectations*--Laboratory goes well beyond the Satisfactory level and is outstanding in many areas. ☐ *Satisfactory*--Laboratory meets expectations and the criteria for a Satisfactory rating. ☐ *Needs Improvement*--Laboratory does not reach expectations and does not meet the criteria for a Satisfactory rating. The reviewer will identify specific problem areas that need to be addressed.
QUALITY ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
RELEVANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
PERFORMANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
Recommendations for Climate Research (including Stratospheric Research) **Please provide specific, actionable recommendations based on your observations/findings**

Evaluation Worksheet 2

Research Area: Air Quality Research
Reviewer: **Overall Evaluation:** ☐ *Highest Performance*--Laboratory greatly exceeds the Satisfactory level and is outstanding in almost all areas. ☐ *Exceeds Expectations*--Laboratory goes well beyond the Satisfactory level and is outstanding in many areas. ☐ *Satisfactory*--Laboratory meets expectations and the criteria for a Satisfactory rating. ☐ *Needs Improvement*--Laboratory does not reach expectations and does not meet the criteria for a Satisfactory rating. The reviewer will identify specific problem areas that need to be addressed.
QUALITY ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
RELEVANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
PERFORMANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
Recommendations for Air Quality Research **Please provide specific, actionable recommendations based on your observations/findings**

Evaluation Worksheet 3

Research Area: Connections: Climate, Air Quality, and the Stratosphere
Reviewer: **Overall Evaluation:** ☐ *Highest Performance*--Laboratory greatly exceeds the Satisfactory level and is outstanding in almost all areas. ☐ *Exceeds Expectations*--Laboratory goes well beyond the Satisfactory level and is outstanding in many areas. ☐ *Satisfactory*--Laboratory meets expectations and the criteria for a Satisfactory rating. ☐ *Needs Improvement*--Laboratory does not reach expectations and does not meet the criteria for a Satisfactory rating. The reviewer will identify specific problem areas that need to be addressed.
QUALITY ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
RELEVANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
PERFORMANCE ☐ Highest Performance ☐ Exceeds Expectations ☐ Satisfactory ☐ Needs Improvement
Comments and observations/findings:
Recommendations for Connections: Climate, Air Quality, and the Stratosphere **Please provide specific, actionable recommendations based on your observations/findings**

Reviewer Feedback Worksheet – Additional Comments and Feedback on the Review Process

Reviewer:
Additional comments for OAR and laboratory management:
Additional comments and suggestions on conduct of the review for use in future laboratory reviews Please help OAR improve our science review process by telling us what worked well and did not work well throughout the process. In order to reduce the burden on you and the Laboratory staff, we would like to provide only the useful background information. What information provided was especially useful or not useful in your evaluations? What additional information would have helped you in your evaluation? What information could have been omitted without impacting the quality of your review?

Appendix D

Contact Information for the CSD Science Review

OAR Assistant Administrator, Mr. Craig McLean
Craig.Mclean@noaa.gov
301-713-2458

OAR Deputy Assistant Administrator, Dr. Steve Fine
Steven.Fine@noaa.gov
301-713-2458

OAR HQ LCI Coordinator, Dr. Mike Uhart
Michael.Uhart@noaa.gov
301-734-1177

CSD Director, Dr. David Fahey
David.W.Fahey@noaa.gov
303-497-5277

CSD Review Coordinators, Drs. Eric Williams and Christine Ennis
Eric.J.Williams@noaa.gov
303-497-3226
Christine.A.Ennis@noaa.gov
303-497-7538

CSD Travel Coordinator for the Review Panel, Ms. Jeanne Waters
Jeanne.S.Waters@noaa.gov
303-497-3134