

Charge Question 7: *To facilitate review for this particular charge question, the panel should focus on three models that represent the diversity of model information housed within the Models Knowledge Base. These models are: (1) **Aquatox**, a water quality model; (2) **Integrated Planning Model (IPM)**, a model to estimate air emissions from electric utilities; and **NWPCAM**, an economic model.*

Using these three models as examples and emphasizing that EPA is not seeking a review of the individual models, but rather the quality of the information provided about the models, EPA poses the following questions to the Panel. Through the development of this knowledge base, has EPA succeeded in providing:

(7a) easily accessible resource material for new model developers that will help to eliminate duplication in efforts among the offices/regions where there is overlap in the modeling efforts and sometimes communication is limited?

(7b) details of the temporal and spatial scales of data used to construct each model as well as endogenous assumptions made during model formulation such that users may evaluate their utility in combination with other models and so that propagation of error due to differences in data resolution can be addressed?

(7c) examples of “successful” models (e.g., widely applied, have been tested, peer reviewed etc.)?

(7d) a forum for feedback on model uses outside Agency applications and external suggestion for updating/improving model structure?

7.0 General Comments

The Panel commends the Agency for developing the Models Knowledge Base and strongly supports its continued improvement. This type of resource has been needed for some time and even in its draft form, the Knowledge Base provides an easily accessible resource for the modeling community that, if maintained and used, will significantly improve the development and application of models both internal and external to the Agency.

In answering questions 7b-7d, the panel focused primarily on the two suggested models (i.e., AQUATOX and IPM) along with a third model selected by the Panel (CalPuff). Actually, no mention is made in the text of the IPM model, although there are plenty of comments on it. One task could be to see if there are new or interesting points that could be made from this example. However, it was necessary to go beyond these models to address question 7a. The Panel interprets question 7a as being asked in the context of a model developer who might use the MKB to screen existing Agency models for use in a specific application or for modeling technology to include in a new model to support a specific decision. In this case the Panel found it necessary to identify a number of similar models (i.e., atmospheric dispersion models or water quality models) and assess first the number of models available to choose from and, second, the consistency, transparency and comparability of the data for these similar models.

In answering charge question 7a, the Panel finds that the MKB has the potential to provide readily accessible information about models; however the amount and quality of

information can be improved. For charge question 7b, the Panel recognizes that the information provided in the MKB is not highly detailed. As a result, sufficient level of detail about scales of data used and assumptions made during the formulation of any specific model in the MKB cannot be obtained from this tool alone. However, the MKB does allow for the initial identification of candidate models with links and references for obtaining further information. For question 7c, the Panel agreed that the three models considered in this review were all good examples of successful models both in their regulatory role and in the way they are presented in the Knowledge Base. For the final question, the Panel was not satisfied with the current form of feedback mechanism for the Knowledge Base. More detailed observations, suggestions and recommendations follow.

7.1 Vision for the Knowledge Base

The issues surrounding which models to include in the MKB are not trivial; the Panel recognizes that this choice can have significant implications for the application of this tool in support of decision-makers. The Panel is concerned that without a clear vision, the MKB may increase the burden on Regional and State offices by implying that a particular model is “endorsed” by the Agency. **The disclaimer on the main page of the MKB makes it clear that models in the Knowledge Base are not endorsed by the Agency but the Panel suggests that this disclaimer be clearly presented at the top of each “Model Report” page as well.**

Part of the vision for the MKB should specify the role of this resource in the development or life cycle of models. More specifically, there needs to be a clear statement about what models are included in the Knowledge Base and what models or types of models (if any) are excluded. This will require that the Agency provide a clear definition of what a “Regulatory Model” is or move away from this terminology towards a more inclusive title. The Panel recognizes that in addition to providing a repository or library of mature models that are actively used by the Agency; the Knowledge Base can play an important role in the development of new models and the improvement of existing models. **For this reason, the Panel suggests that the agency recognize that models have lifecycles (if they don’t already) and recommends that the Agency include models at all stages of their life cycle with a process for identifying to users those models that are new, actively being develop, currently used for decision making and nearing retirement.**

An important aspect of any model repository from the perspective of a model developer or new model user is that it be as comprehensive as is feasible. In other words, users must be confident that when they use the MKB to identify an appropriate model for a task, it is likely that all relevant models have been considered. The draft MKB provides a good start but needs to continue to incorporate additional models used by the Agency. Many of the Agency’s Offices, Programs, and Regions have developed their own clearing house for models; the Agency should make an effort to bring these existing data bases under the umbrella of the Knowledge Base. **The Panel recommends that the Agency identify these parallel Agency supported databases (e.g., the Support Center for Regulatory Air Models (SCRAM), the Center for Exposure Assessment Modeling (CEAM), etc.) and develop a plan to incorporate them into the MKB. If it is not feasible to incorporate these existing databases at this time, then the Panel suggests**

providing a current list of – and links to – these additional databases on the main page and the search page of the MKB.

The process of identifying and including existing models is clearly an important step to insure that the Knowledge Base is comprehensive. It is also important to continue to populate this MKB with new models as they emerge. **To accomplish this, the Panel recommends that the Agency incorporate new models into the Knowledge Base as part of their initial application within the Agency.** The information in the MKB for a given model is, or should be, part of the model development process so submitting this information as part of a model's initial application should not be an added burden to the model developers. Nevertheless, the Panel recognizes that it may be necessary for the Agency to provide additional incentive (positive or negative) as part of their plan to encourage what is currently a voluntary effort by modelers to put their model in the MKB.

7.2 Quality Assurance and Quality Control

In addition to its role as an institutional memory, the MKB, in its current form, is clearly a tool designed and developed to support regulatory decisions by delivering useful information about prospective models for specific applications. The database itself is not unlike other “models” developed to support regulatory decisions. As noted in CQ6, the development of the MKB and the information provided in it should be subject to the same level of quality control and quality assurance that any Agency modeling effort is expected to include. **Therefore, in addition to the Vision Statement discussed earlier, the Panel recommends that the Agency provide a link on the main page of the Knowledge Base that takes the user to the Agency's plan for insuring the quality (integrity, utility and objectivity) of information provided.** At a minimum, this should contain the following elements:

- Problem specification that identifies the drivers for setting up the MKB (i.e. reduce duplication of effort, improve networking, facilitate model development, satisfy training needs, ...)
- Clear identification of the user community or “clients” for the MKB. There was some ambiguity among the Regional representatives at the face-to-face meeting about whether the Knowledge Base satisfied their specific modeling needs and as a result there appeared to be a lack of “buy in” from EPA's regional offices.
- Identify specific performance criteria for the MKB information along with selection criteria for models in the database and identify who will be responsible for insuring that these criteria are met.
- If non-Agency models are eventually included in the MKB (see previous bullet on selection criteria) then the QA/QC plan should identify how these models will be treated or presented and who will absorb the burden of oversight for these models.

The level of detail provided by each model should also be balanced. In the draft MKB, the details provided for models differ widely. An example of a model where information is very sparse is TRACI. Scientific detail is often just a statement of units

used in the model (e.g., the SWIMODEL includes only the following statement under Scientific Detail “The model uses fixed units (S.I.)” and is missing Conceptual Basis all together). In other cases, it is not apparent that the sections include comparable information. For example, it is often difficult to distinguish between the Conceptual Basis, Scientific Detail and the Model Framework sections. **The Panel recommends that improved guidance be provided as part of the data entry sheet to insure that the correct type of information is input into each field.** This will also facilitate search functions by making sure those submitting the information realize what fields are searched. It may be necessary to request a keyword list from the model developer. As an example of this last point, the Panel found that the CalPUFF was not identified in the key word search using the phrase “air dispersion”. Although “air” and “dispersion” are in the title or abstract, the phrase “air dispersion” is missing and as a result the model is not identified when the search is based on this common phrase. **In another case -- a search for “vapor intrusion” models (currently a timely topic) -- there  no matches in the MKB.** A search for “indoor air” models produced three matches, but none that appeared usable for the vapor-intrusion set of problems. This illustrates that there is still some significant work ahead to verify that the priority regulatory problems being addressed in Regional offices of EPA today are adequately considered in selecting candidate models to be included in the Models Knowledge Base.

7.3 Layout and Navigation of Knowledge Base

The Panel reviewed the information provided in the MKB in Question 5 and, in addition to information that is currently provided, identified several additional pieces of information that should be elicited when a model is introduced into the Knowledge Base. In this section, the Panel provides observations about the current layout of the MKB and provides suggestions for where new information should be presented.

The current layout of the MKB is logical and generally easy to maneuver (with some exceptions noted later). The Panel found that much of the summary level material was readily accessible on the three main Report pages. The more detailed information is generally available through appropriate links. However, the Panel notes that in several cases, including the CalPuff model, information is not provided for specific fields and rather than leave these fields blank, they are apparently removed from the Report. For example, the “Model Framework” and the “Model Evaluation” fields are often missing. The Panel recognizes that the Agency attempted to “cull information about models that broadly serve the needs of all users...” but once this minimum information is identified, it should be provided for all models. **The Panel recommends that if information is not provided for specific fields, those fields should be left blank rather than be removed from the Report. A blank field provides clear information about a model while a missing field is ambiguous.**

Overall, it was possible to use the MKB to obtain general information about the existence and availability of frequently used models and more detailed information about a specific model. But, really understanding how a given model works and what its specific strengths and weaknesses are would appear to require either going into the detailed documentation or contacting an actual user.

Navigating the knowledge base was somewhat cumbersome, in that apparently different links go the same destination, links to critical information (e.g., model change bulletins) are obscure, and return links (i.e., return from exit disclaimer) take the user to the key word search page rather than the previously viewed page. In addition, several different pages (10 in the case of CALPUFF) needed to be accessed to gain a sense of model operation and capabilities. Perhaps accommodating the somewhat bewildering array of models and their varying characteristics is what's causing these navigational inefficiencies but, regardless, it would be helpful if access to model information could be more streamlined.

7.4 Updating the Knowledge Base

The Panel recognizes that the MKB is a “living demonstration of the recommendations from the Guidance for Environmental Models”. This suggests that the Knowledge Base will evolve and adapt to the specific needs of the user community. The comments above also support the premise that this will be an ongoing process of optimization. Optimizing the MKB will ultimately require an understanding of the user community and an active and transparent feedback mechanism. To facilitate this, the panel recommends that voluntary user profile and registration information be requested so that use profiles can be developed. This information can also provide a mechanism for announcements to be distributed when necessary.

Improving the MKB and the models contained in it will ultimately depend on the quality of feedback from “external users” and the ability of new users to access this information. The Knowledge Base is currently limited to a single contact and does not provide any suggested format for comments nor does it provide for open dialogue and discussion of modeling experience. This seriously limits the Agency’s ability to adapt the MKB and improve its utility. This lack of an open forum also limits the model developers from gaining experience from model users and it limits the ability of new modelers to learn about specific experience and application of a particular model. **The Panel recognizes the challenges associated with hosting an open forum on an Agency web site but recommends that the Agency reconsider including a transparent user feedback mechanism that will facilitate an open dialogue for the models in the MKB.**

7.5 The Role of the Knowledge Base as a “Model Selection Tool”

The panel is not entirely convinced about the utility of a model selection tool or expert system that accesses the MKB to facilitate model selection. However, the Panel suggests that if such a tool is developed for application at the regions, labs and states, then the effort should be considered “model development” and as such should clearly follow the guiding principles described in the [Guidance on Environmental Models \(TLT query—is this the same as the REM guidance? Yes.\)](#).

If such a model selection tool is developed, it will likely be used early in the life of a project so identifying specific needs and valuing these specific needs in a way that would facilitate a model ranking would be difficult to achieve. **Therefore the Panel recommends that any tool developed by the Agency to facilitate model selection based on the Knowledge Base should simply present the models in a comparative**

matrix in the form of a side-by-side comparison table like one would see in the car sales industry.

Appendix B provides more detailed information about Panel members' experiences in accessing and using specific models.
