Review of

Proposed Definition of Unusually Sensitive Areas (USAs), Filter Criteria, and Model

Submitted to:
American Petroleum Institute (API)
and
Office of Pipeline Safety (DOT/RSPA)

By

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Introduction

On the 27th and 28th of April 2000 the Office of Pipeline Safety (OPS/DOT/RSPA) and the American Petroleum Institute (API) jointly sponsored a technical/peer review meeting and workshop of experts on biodiversity and drinking water resources to review the definition of a USA (Unusually Sensitive Area), designed models and filters, and the results of pilot tests, sponsored by these groups, from biological and water-resource data available from California, Louisiana, and Texas. The primary objective of the workshop was to allow panelists to evaluate, discuss, and investigate the theories and applications involved in defining USAs, the applicability and effectiveness of the USA in protecting diversity and drinking water resources, the implications of the filters involved in the model, and the resulting outcomes of the model in pilot tests conducted in the three states. Below, I address the applicability and effectiveness of the current USA definition for ecological resources, evaluate the designed model and filters, evaluate the adequacy of the data, and evaluate the quality of the USAs resulting from the model relative to the objective to protect areas unusually sensitive to environmental damage that could result from an accident in a pipeline containing hazardous liquid .

Background Information

The USA Definition

USA refers to an Unusually Sensitive Area and these can be of two types. First there are candidate USAs and then after these have been passed through the model and filter criteria there result the USAs used in the decision-making process. As developed in the model, a candidate USA can derive from one of two different reasons, including (1) drinking water supplies and (2) ecological resources, either of which may be sensitive to environmental damage in the event of an accident in a pipeline containing hazardous liquid. Logically, as outline in the documentation, candidate USAs and resources must be located geographically. As outlined in the documents for the workshop, examples of candidate USAs for ecologically sensitive areas include those areas containing critically imperiled and imperiled species, threatened and endangered species, depleted marine mammal species, and high concentration areas that contain a large percentage of the world population of migratory waterbird species, (i.e., Ramsar sites and Western Hemisphere Shorebird Reserve Network (WHSRN) sites.

Following the identification of candidate USAs the system then involves a model, incorporating the potential of GIS, wherein one applies a series of 'filter criteria', based on scientific and technical principles, to select a subset of the above referenced geographic areas (candidate USAs) that are deemed unusually sensitive. In the current system these represent the USAs of concern in pipeline protective measures. Given the identification of these USAs one may then overlay the pipeline mapping system in the GIS system to determine intersections of unusually sensitive areas and pipelines. Where these intersections occur then risk assessments can be conducted and extra protective measures can be incorporated in pipeline areas.

In March 1999, OPS and API began a joint pilot study of the current model using GIS technology for the mapping portion of the effort. The pilot study was conducted in California, Texas and Louisiana. These states contain about forty-six percent of liquid pipelines in the US. The purpose of the pilot was to determine whether there are good data sources available to

support the model, and whether the model provides a functional definition that can be used throughout the US to define USAs from candidate USAs.

Currently API and OPS define a USA as follows:

Those definable geographic areas that contain drinking water or **ecological resources** that by their character are irreplaceable and may be subject to irreparable and irreversible injury or irretrievable loss, if they are exposed to the effects of an accidental hazardous liquids release. (emphasis added)

This definition and level of protection from hazardous liquid pipeline accidents is over and above a series of other protective measures. Currently there exists a number of natural resources that are afforded various levels of protection under a number of State and Federal laws. These laws mandating protection include such diverse geographies as federally owned lands (e.g. park, forest, and reserve boundaries), ecological regions (e.g. wetlands, estuaries and river systems), water bodies (e.g. lakes, rivers, drainage basins and groundwater aquifers), cultural resources, and locations of individual species occurrence (e.g. threatened and endangered species). Unusually sensitive areas currently do not incorporate the entirety of all federally protected natural resource areas. Rather, the term "unusually sensitive areas" represents a subset of these resources that may be subject to "permanent and long-term environmental damage" and, therefore, is consistent with the language of the APSPA.

The above USA definition is, therefore, focused upon those environmental resources that are potentially at risk of such damage and are essential to the protection of human health and the continued viability of ecological resources. Thus, application of the USA definition, as it is established, specifically identifies drinking water resources that are critical to the uninterrupted delivery of consumable water to public water systems and areas critical to the survival and viability of threatened, endangered, and imperiled biological species.

What Constitutes Critically Imperiled/Imperiled Species and Subtaxa and other Candidates for USA?

Herein, I review the possible candidates for consideration of USA. In the currently designed model candidate USAs include (1) critically imperiled and imperiled species and subtaxa, (2) depleted marine mammal species, (3) Threatened and Endangered species as recognized by the Department of Interior, and (4) Western Hemisphere Shorebird Reserves.

The Critically Imperiled and Imperiled Species and subtaxa include plant and animal species at risk of extinction due to their extremely restricted distribution or limited numbers. This information has been developed by Natural Heritage Programs and Conservation Data Centers in conjunction with The Nature Conservancy (TNC). Using the TNC approach, each species is assigned a Global (or range-wide) Conservation Status Rank. This rank is based on several specific factors, including:

Criteria for THC G-rankings of Species

1. the number of known occurrences or populations,
2. number of individuals, health of the population,
3. its extinction potential,
4. whether it is experiencing an increasing or decreasing trend,

and

5. if there are known threats to the species.

By the TNC definition, critically imperiled taxa are considered extremely rare (5 or fewer occurrences or fewer than 1,000 individuals) or extreme vulnerability to extinction due to some natural or man-made factor, on a global scale. There are approximately 1,300 species in the United States that are ranked as critically imperiled globally. Rare or extremely vulnerable subtaxa that are critically imperiled are included in this category, despite the conservation status of the species as a whole. Imperiled taxa demonstrate rarity (6 to 20 occurrences or 1,000 to 3,000 individuals) or vulnerability to extinction due to some natural or man-made factor. There are approximately 1,800 species in the United States that are ranked as imperiled. Rare or vulnerable subtaxa that are imperiled are included in this category, despite the conservation status of the species as a whole.

Depleted Marine Mammal Species are taxa identified and protected under the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 et seq.). The term "depleted" refers to marine mammal species that are listed as Threatened and Endangered, or are below their optimum sustainable populations (16 U.S.C. 1362). The term "species" includes species, subspecies, or population stocks. There are currently 18 species listed as "depleted" under the MMPA. Eleven of these species are also listed as endangered and three of these species are listed as threatened under the Endangered Species Act.

Threatened and Endangered (T&E) Species are animal and plant species that have been listed and are protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

USA candidates include those areas containing important drinking water and ecological ESAs sources. These candidates are areas that contain ecological resources that are potentially more susceptible to permanent or long-term environmental damage, regardless of land ownership, management, or proprietorship.

Western Hemisphere Shorebird Reserve Network (WHSRN) -- The Manomet Center for Conservation Services coordinates the effort to conserve areas of critical shorebird habitats throughout the Americas. WHSRN is a program of Manomet in collaboration with other public and private organizations worldwide. This program identifies and delimits areas where significant populations of migratory waterbirds congregate during critical periods. A second program, the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar), is also dedicated to the identification of globally critical wetland areas supporting migratory waterfowl.

Ecological Resource Data Sources
The documents provided for panel members offered the following information regarding these data sources. "A number of data sources can be used to help identify ecological USAs. These data sources reflect both the nature of the landscape (i.e. surface of the earth) and the distribution of ecological resources upon the landscape. The identification of USAs requires spatially explicit candidate resource occurrence data. Candidate resource occurrence data describe the actual locations where individuals or populations of candidate species or subtaxa occur, or where Ramsar and Western Hemisphere Shorebird Reserve Network (WHSRN) sites have been established. Spatially explicit means that the actual location of these occurrences is represented in map based terms, as in latitude/longitude coordinates or other geographic units.

Data location quality/sources
Ecological USA candidates must be mappable to sufficient precision such that there is a high likelihood that the species or subtaxa occurs within the identified habitat area. To meet the data specificity needs of the USA process, species or subtaxa distribution data must be based upon known occurrences that are mappable to one minute, or greater, precision. One minute of a degree roughly translates to 1 mile in most parts of the globe. Data that meet these requirements allow for the development of effective site-specific risk assessment and protective measures.

Of the species and subtaxa distribution data sets available, the Natural Heritage Program element occurrence database most effectively meets these data location quality requirements for terrestrial and freshwater ecological resources. Natural Heritage data are maintained on a state and regional basis under an initiative conceived of and fostered by TNC. Attributes vary from state to state. In many states, extensive work has been done to populate the standard Nature Conservancy data model, including attributes on data accuracy, precision and species characteristics. In other states, only a base level of data is available. Information on the TNC data model is available on the internet.

For coastal, marine, and some inland resources, the Environmental Sensitivity Index (ESI) data sets most closely meet the data location quality requirements. The ESI data sets are composed of three primary elements, 1) Shoreline Classification, 2) Human-Use Resources, and 3) Biological Resources (Halls et.al., 1997). Of these three elements, the biological resources element provides ecological USA candidate occurrence data and compliments the Natural Heritage Program element occurrence database.

The boundaries of migratory waterbird concentration areas identified by the Ramsar and WHSRN programs have not been fully mapped in all cases, but available site descriptions do provide sufficient detail to allow them to be mapped consistent with the above data location quality requirements. Information on the Ramsar and WHSRN sites is available on the internet or from the U.S. Fish and Wildlife Service, Office of International Affairs.

Other data sources were evaluated for utilization as USA ecological candidate resource occurrence data, but did not meet requirements for data access and standardization, site specificity, or exceed the quality of data more readily available from other sources. Several of

these ecological resource mapping programs may achieve the necessary data location quality requirements in the future.

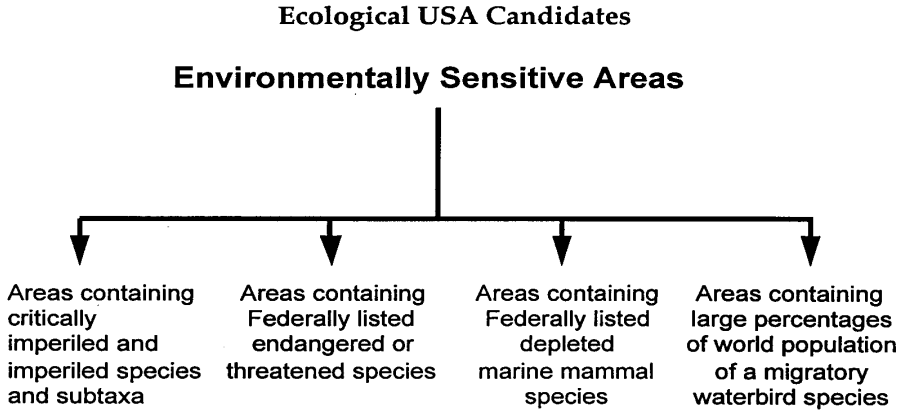
Data sets and individual data records that do not currently meet these criteria will be periodically re-evaluated for changes in data quality. This re-evaluation is necessary because these data sets and individual records are periodically revised and upgraded by the various responsible entities as new information becomes available.

Ecological USA Candidates

Ecological USA candidates are a subset of ecological ESAs. These candidates are areas that contain ecological resources that are potentially more susceptible to permanent or long-term environmental damage, regardless of land ownership, management, or proprietorship.

Four resource categories have been identified as ecological USA candidates (see figure and discussion below). These categories are susceptible to permanent or long term ecological damage due to inherent characteristics of rarity, imperilment, or the potential for loss of large segments of an abundant population during periods of migratory concentration.

A. Areas Containing Critically Imperiled and Imperiled Species and Subtaxa.
These areas contain known occurrences of animal and plant species that have been designated by The Nature Conservancy (TNC) as Critically Imperiled or Imperiled.



B. Areas Containing Federally Listed Threatened and Endangered (T&E) Species.
These areas contain known occurrences of animal and plant species that have been listed and are protected under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

C. Areas containing Depleted Marine Mammal Species. These areas contain known occurrences of depleted species identified and protected under the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 et seq.).

D. Areas Containing a Large Percentage of the World's Population of a Migratory Waterbird Species. These areas contain very high concentrations of the world's population of a species for a short period of time. An example would be the parts of Delaware Bay where a major portion of the world population of red knot (a shorebird species) stop-over to feed during migration.

Ecological Filter Criteria

In the current model developed there are three ecological filter criteria that are considered by API and OPS as consistent with current trends in conservation ecology. These filter criteria identify areas with critically imperiled species, multi-species protection sites, *and migratory waterbird concentrations*. Below, these filter criteria are presented and discussed (from documents provided to panelists).

Filter Criterion 1: Areas with Critically Imperiled Species

Filter criterion 1 selects those ecological USA candidates that are viable occurrences of species or subtaxa designated as critically imperiled globally to be USAs. This ranking is based entirely upon TNC considerations. These species or subtaxa are argued to demonstrate extreme rarity or extreme vulnerability to extinction due to some natural or man-made factor. They typically have five or fewer occurrences or fewer than 1,000 individuals globally. In some cases, species or subtaxa may be identified as critically imperiled because they are subject to an extreme threat of extinction due to factors other than low number of occurrences or individuals.

The critically imperiled designation includes a wide variety of plant and animal species and subtaxa. It includes approximately 64 percent of the listed threatened and endangered species and 53 percent of those species currently designated as proposed or candidates for listing under The Endangered Species Act. This filter criterion also selects an additional number of plant and animal species and subtaxa that are not designated under The Endangered Species Act. All ecological USA candidates meeting this criterion are considered USAs. Ecological USA candidates that do not meet filter criterion 1 are retained for consideration under filter criteria 2 and 3.

Filter Criterion 2: Multi-species Protection Areas

Filter criterion 2 selects those ecological USA candidates that form multi-species assemblages. Multi-species assemblages are defined as areas where three or more different critically imperiled or imperiled species, federally threatened or endangered species, species federally-listed as essential experimental populations, depleted marine mammals, or migratory waterbird concentrations co-occur.

Whereas filter criterion 1 selects the critically imperiled occurrences of individual species or subtaxa, filter criterion 2 selects ecological USA candidate areas where multiple species, subtaxa, or migratory waterbird concentrations co-occur. These areas are valuable as they often represent unique ecosystems and they also protect a greater number of sensitive resources per site location.

Filter Criterion 3: Migratory Waterbird Concentration Areas

Filter criterion 3 selects those ecological USA candidates that are designated as Ramsar sites and meet the specific waterfowl criteria, or WHSRN sites ranked as hemispheric, international, or endangered species reserves.

Filter criterion 3 focuses on areas where significant populations of migratory waterbirds congregate during critical periods. Relatively common species may be at risk at such sites. In some cases, as much as 80 percent of the entire North American population of a particular species may occur at one of these sites during critical concentration periods (Harrington and Perry, 1995).

Implementation of USA Identification Process for Ecological Candidates

API and OPS developed a process for identifying ecological USAs from base map data and candidate occurrence data that meet the data location quality requirements outline above. "The process is implemented by first creating generic polygons for all candidate occurrences existing only as point locations. These generic polygons are then combined with existing candidate occurrence polygon data. This combination creates a complete candidate occurrence data set. The polygons from this data set are associated with base map data to establish the relationships of individual occurrences with landscape features, and to determine proximity to other occurrences."

Creating Polygons from Candidate Occurrence Data

The following information was presented in the documentation provided to panelists. "In the development of an approach to the designation and mapping of USAs, the primary goal of providing adequate protection to areas of unusual ecological sensitivity necessitates the adoption of a rule set that enables resources of innately different ecological character to be dealt with differently within the model. Further, the inherent limitations of currently available data sets supporting the model tend to favor generalization of mapping procedures, in cases where greater specificity may be justifiable on an ecological basis. The remainder of this section provides recommendations for procedures to be utilized to resolve a number of specific mapping problems and is based upon current data availability and limitation.

Within the ecological USA methodology, there are three possible types of USA polygons. The first type of polygon is a resource based mapped polygon. This type of polygon is derived directly from mapped resource occurrence areas contained within the Natural Heritage and Environmental Sensitivity Index data sets, when available. As these polygons are mapped on the basis of recent field observations, they are to be accepted as best available characterization of resource areas and are utilized preferentially over other derived areas. Aside from these relatively rare polygons, the majority of resource occurrence areas are derived as either terrestrial or aquatic areas. Derived terrestrial areas and isolated aquatic areas will incorporate circular areas of the landscape within one mile of the coordinate location designated in the Natural Heritage data set. Aquatic, or open non-isolated water, areas will incorporate all connected open waters within a five-mile radius from the occurrence location. Aquatic occurrences will also extend one-fourth mile on either side of mapped open waters so as to incorporate associated important riparian areas.

Differential Treatment of Aquatic and Terrestrial Species

Due to perceived differences in the way that aquatic resources are distributed on the landscape and in the way that spilled hazardous liquids move in aquatic habitats, versus terrestrial habitats, a number of habitat types have been developed with corresponding differences in the size and shape of the candidate USA. Generally, the occurrence locations of all terrestrial species should be represented as a one-mile radius circle around the coordinates of the occurrence. Such an area is designated so as to accommodate for uncertainties and inaccuracies about the actual location and area included in the occurrence and to afford an ample geographic buffer of protection around unusually sensitive ecological resources. Aquatic species should be subdivided according to their dependence upon, or occurrence within, the various aquatic environments listed below based upon Correll and Correll (1975).

Those species that occur predominately in larger bodies of water and non-isolated water should be treated as open water species. That is, their occurrences should be represented as all connected waters within a five-mile radius of the coordinates of the occurrence location.

The occurrences of those species that occur predominately in, or associated with, isolated or ephemeral water bodies should be treated as terrestrial occurrences with a one mile radius circle around the coordinates of the reported occurrence.

Aquatic species: species that spend a significant portion of their lives, a life stage, or important life-history activity within, upon, or regularly in contact with aquatic habitats. Such species are unable to utilize terrestrial environments or to move significantly away from aquatic environments during an aquatic habitat dependent portion of their life cycle. Includes species that may live in terrestrial environments but which derive an obligatory portion of their resource needs from aquatic environments.

Terrestrial species: species that are able to utilize habitats that are not dominated by or dependent upon the presence of free water at the surface. Such species may visit aquatic habitats on a regular basis but do not require constant or regular contact with or derivation of food from aquatic habitats.

Aquatic/Terrestrial species: Species that utilize both aquatic and terrestrial habitats for discreetly different resource requirements for some portion of their life cycle. Examples of such species include species that have nests in areas that are distinctly terrestrial but which feed in aquatic or marine environments (e.g. marbled murrelet and peregrine falcon). As the activities performed in these different habitats are distinct from one another and as the areas may be geographically distinct from one another and different in size and configurations, the areas should be treated as separate areas and should be treated as either terrestrial or aquatic. For example, old growth forest areas that support nesting of marbled murrelets should be designated by USA candidate areas with a one-mile radius. The marine feeding areas of marbled murrelets should be designated by five-mile radius circles that include all connected waters plus a _ mile overlap onto land.

General Review of Project

Below, I provide my general assessment of the proposed plan for Ecological Sensitive Areas. Following this conclusion I comment on the various aspects of this project requested in the documentation provided by API and OPS. First, I address the three assumptions of the ecological model and provide recommendations for future modifications of the plan. These include:

> (1) The most sensitive ecological resources, which might be considered to be "unusually sensitive," are those resources that are susceptible to eradication, or irreparable reduction in numbers, that might result from localized events occurring within the range of their areas of habitation or frequent use.
>
> (2) Areas of high ecological diversity, or ecological specialness, are often indicated by a concentration of species with a restricted distribution area, or rareness. Such areas can be identified through a process of locating "clusters" of rare species. These areas possess a high sensitivity and should be considered "unusually sensitive" and
>
> (3) Some species, although not particularly rare, do possess characteristics of local concentration during a portion of their life cycle. This renders the species potentially susceptible to localized events that might occur in the concentration areas "unusually sensitive."

Following the evaluation and recommendations of these assumptions I will address 5 outlined issues provided in the technical review panel documentation and make recommendations to improve the plan in future years. These include:

> (1) assumptions that underlie the current Ecological USA definition and model;
> (2) appropriateness of the proposed model for identifying ecological USAs;
> (3) adequacy and appropriateness of the data sources for
> (a) implementing the current model and
> (b) identifying unusually sensitive species;
> (4) data collection and manipulation processes and procedures that were conduced to implement the model, and
> (5) results of the pilot tests.

Overall Determination of Adequacy of Definitions and Model Development

In general, I feel that the current definition of a USA and the model/filter system is adequate for the first year of implementation of the plan. I am generally quite pleased with the concerted effort and cooperation that went into the development of these protective measures of both drinking water and ecological sources by API and OPS. Thus, I support the use of this model, as currently conceived, for the first year. However, there are some concerns that I have with the model as currently conceived. As such I provide some recommendations below to improve the model from implementation in the second and future years. I do consider these revisions to be extremely important to the success of this program implementation.

Three Assumptions of the Overall Plan and Model for Ecological USAs.

(1) The most sensitive ecological resources, which might be considered to be "unusually sensitive," are those resources that are susceptible to eradication, or irreparable reduction in numbers, that might result from localized events occurring within the range of their areas of habitation or frequent use.

In general, I agree with this assumption. However, the current model is built on the basis of imperiled species distributions. Future efforts should be invested into incorporating other unusually sensitive resources. Some of these were specifically excluded from the current model and these are outline in the documentation for the model.

(2) Areas of high ecological diversity, or ecological specialness, are often indicated by a concentration of species with a restricted distribution area, or rareness. Such areas can be identified through a process of locating "clusters" of rare species. These areas possess a high sensitivity and should be considered "unusually sensitive" and

In general, I do not agree with this assumption. Biogeography of life on earth has varied histories. In some instances there are replicated patterns of distributions of species and you may have high concentrations of species in a general area. However, these species may not all be rare and thus identified by "clusters" of rare species. Areas of high ecological diversity can be easily missed if one concentrates on rare species only; the major areas of high levels of biodiversity may not coincide with clusters of rare species. Unfortunately, the current model is restricted to TNC data on critically imperiled and imperiled species or the USFWS list of endangered and threatened species. If the objective of the model is to protect imperiled taxa and areas of high ecological diversity then these will need to be evaluated independently.

Recommendation: In the future development of this model all species should be considered using the power of the GIS system to identify areas of high species concentrations. These areas should be protected as well as areas where clusters of imperiled taxa occur. I also argue below that the use of three overlapping imperiled species is probably not adequate to protect the unusually sensitive species. It is not clearly defended that there is enough replication of geographically proximate imperiled species to expect that the outlined objective of the model can be achieved. Because concentrations of imperiled species do not necessarily coincide with areas of high species diversity the assumption of "clusters" of rare species may not be adequate. However, this should be researched further using complete inventory data of floras and faunas of areas and compare these results with results of focusing on "clusters" of rare species. This research should also be conducted at academic institutions with original data sources (not TNC data and their listing criteria) and should be funded by DOT and other agencies that will benefit from a progressive model of biodiversity of the US as being constructed by API and OPS.

(3) Some species, although not particularly rare, do possess characteristics of local concentration during a portion of their life cycle. This renders the species potentially susceptible to localized events that might occur in the concentration areas "unusually sensitive."

I agree with this assumption. However, I do not think that the current model, being restricted to avian areas, is adequate for future use and protection of all USAs of this nature. Avian species are not the only biodiversity that are migratory. Some mammal, amphibian, and fish species, in addition to migratory birds, are known to spend a portion of their lives in migration to habitats that are not normally occupied at other times of their life cycles. Among amphibian species many salamanders and frogs migrate to wetland habitats to reproduce in the spring . These same species may not occupy these aquatic habitats during other seasons of the year. Among fishes, many species are known to be migratory during their spawning seasons. These species typically migrate upstream to spawning areas where the eggs are released and fertilized. Finally, among fishes, many aquatic habitats are known to serve as important nursery areas of developing young. None of these areas are currently considered in the present proposed model but must be included in future modifications of this model.

Evaluation of the five issues in the technical review panel documentation

(1) assumptions that underlie the current Ecological USA definition and model.
In general, I agree that the general assumptions underlying the current Ecological definition and model are acceptable with the exceptions that I outline below under the sections on the model and filter criteria and data sources. These recommendations I consider to be mandatory changes in the Ecological USA definition and model following the first year of implementation of the model.

(2) appropriateness of the proposed model for identifying ecological USAs.
The theoretical design of the model is outstanding and goes beyond my initial expectations of the system when I was first asked to participate in the panel. I think that, in general the logic is good. I applaud the group responsible and their support staff for such a forward-thinking application of biological information in the development of a nation-wide further industrial development in concert with preservation of our nation's diversity of life.

Having said this, I am concerned with a few issues that are currently in the proposed model. I have serious concerns about the source data for the model, but this will be discussed in the following section. My other concerns involve (1) the use of TNC data and their listing method of species, (2) the idea of multispecies areas, (3) the limited used of original data sources for model construction, and (4) the lack of evaluation of overall species diversity of areas (inclusive of all diversity of a state).

I do realize that this has been a long and difficult process in developing the model, that there probably have been difficulties in obtaining original data on biological diversity with geographic locators, and that the model will be revised. This is probably why API and OPS purchased TNC data. This, however, I feel is, or could be, a mistake. TNC data are obtained from Natural Heritage Programs. Some of these programs do not have very accurate locality information unless they have obtained them from curators of collections. Unfortunately, many, many curators of collections have refused to participate with TNC because of their historical policy of not providing support to the collections that have developed the very data sources that they need. If data are obtained from Curators these data are held by TNC, not to be released to any party unless the party can pay for the information. This is exactly how the TNC data were obtained for

the proposed model. Historically, none of this money has been returned to Curators and collections where the original data originated.

Secondly, the G1, G2, etc. listings developed by TNC are largely unrealistic for several reasons. The major reason is that they count the number of locations where a species has been taken and have almost no data as to population sizes of imperiled species. There is no control over sampling methods that would make TNC data reliable in terms of developing a global ranking system. For example, there are species in many states that have very few occurrences because they live in habitats that are very difficult to access and we know from independent resources that they are not as rare as would be indicated by voucher specimens in collections that form the reference materials for "dots" on a map! Thus, sampling effort for these difficult to access species status are not equivalent to those made for imperiled and non-imperiled fishes in smaller streams, creeks, or springs. Thus, looking at a map for numbers of dots is not appropriate for determining G1, G2, etc. rankings.

Finally, the abundances of species is also used in TNC rankings. This is extremely useless for the vast majority of biological diversity! Only in rare instances can one determine with any level of confidence what the abundance of an imperiled species might be. True, there are some instances (California Condor) where a G1, G2 ranking may be applicable because all individuals are accounted for. However, this is extremely rare.

(3) adequacy and appropriateness of the data sources for
(a) implementing the current model and
(b) identifying unusually sensitive species.

For the first year of implementation of this model I feel comfortable with the current model and the data set employed. However, I cannot stress enough the inadequacies of TNC data for the purpose of this model. This is discussed in the previous section.

I do not feel that the requirement for 3-species overlap is adequate for protecting USAs. I think that this should be reduced to at least 2 species overlap, except in instances where there are very few occurrences of a species and it is considered threatened or imperiled. In these instances all populations should be protected. It is not clear to this reviewer as to how and why TNC used the criteria that they used to differentiate between G1 and G2 categories. This, given the shortcomings of their listing method (addressed above), leads me to seriously question the utility of their data. As address above the biogeographic histories of different elements of our biodiversity does not indicate that we should see replicated distributional patterns of imperiled species at the scale that this model is working. Regionally, yes this could be true and you will find high levels of imperilment in some areas of the US. However, at the scale that this model works I would not expect to find high levels of geographic complementarity of imperiled species. Thus, 3 species overlap is probably not adequate and should be revised in the future revision of the model to either 2 or 1 species.

Another inadequacy of TNC data is that it does not include undescribed species and subtaxa in their rankings. The USFWS does list and protect undescribed species and subtaxa if there is adequate documentation for their existence. Likewise, regional studies of different taxonomic

groups (Southeaster Fishes Council) have been conducted by groups of professionals of the target organisms. These groups have provided relative rankings of taxa and for those that are endemic to the regions provide status information (fide USFWS criteria) of described and undescribed species. Just because a species has not yet received formal taxonomic description this should not preclude its inclusion in the model.

(4) data collection and manipulation processes and procedures that were conduced to implement the model.
Again, as mentioned above, I am generally pleased with the implementation of the model for the first year of application. However, I feel very strongly that the model needs to be revised in the coming year to include many aspects addressed above. I have already commented about my concerns of focusing on just imperiled species (USFWS -T+E; TNC - G1, G2) and not looking at all species distributions to locate areas of high diversity. I have also commented on the general inadequacies of the TNC data set relative to species and locality data that are available from individual curators and collections. I have already commented on my concerns of the 3 species requirement for multi-species USAs. I have already commented above on the inadequacies of just focusing on avian migratory areas. All of these issues must be addressed in the necessary revisions of this model.

My only other concern is how is the occurrence of variable TNC global rankings and the need for developing an algorithm to do rounding of variable ranks. I was my impression that TNC provided a global ranking for species and this is one reason why API and OPS adopted their system. The occurrence of variable global rankings by TNC indicates to me that their data do not meet one of the primary criteria for data to be included in the model. That is, the following criteria were expected before data could be used:

1. Nationally uniform resource standards and criteria so that equivalent resources receive equivalent sensitivity assessments regardless of regionally based priorities.

2. Sources of USA data must be readily available to the public and uniform in criteria and standards.

Given the global rank variability that was provided by TNC (see pgs. 44-45 of documentation for panel members) it is clear that TNC does not have a global ranking criterion of individual species if they occur in different regions or states. The algorithm developed for rounding these data may be adequate, I cannot address this. However, the fact remains that TNC does not have a uniform standard for ranking of species nation wide.

The other point that should be address from the above quotes is that it is not clear that the TNC data are "readily available to the public." It is my understanding that these data must be purchased from TNC and that TNC sold the data to API and OPS with the stipulation that these data could not be made available to outside sources. If this is true then these data do not qualify under criterion 2 listed above.

(5) results of the pilot tests.

In looking over the general results of the pilot test I was generally pleased with the outcome. However, I think that more areas in Texas and Louisiana would warrant protection from pipeline activities if the model was based on a 2 species filter criterion rather than a 3 taxon filter criterion.

I will, however, note in all fairness to those involved in developing the model that this is a wonderful first step to the protection of sensitive areas. I am aware of restrictions on data availability from museums, curators, and individual collections. However, I also know that many of these institutions would readily provide information for use in protective measures of biodiversity of this nature. Thus, given the limitations placed on those involved in the model production I feel that this is an excellent first step towards developing a national data base to use for pipeline development and production that is in concert with the protection of biodiversity.