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March 3, 2015

Mr. Jack Cushing
Division of New Reactor Licensing
Office of New Reactors
US Nuclear Regulatory Commission
Washington DC 20555-0001

Dear Mr. Cushing:

Subject: Knowledge Transfer Report for Dr. Michael Masnik for NRC Agreement No. NRC-HQ-25-12-D-0004, Task Order 002 (formerly JCN QPI04), "Knowledge Management"

Enclosed is the Knowledge Transfer Report for Dr. Michael Masnik for "Knowledge Management," under Basic Order Agreement (BOA) 62893, "Technical Assistance Activities Related to the New Reactor License Application." This report can also be found on EARRTH:

https://earrth.pnnl.gov/ologies/aquatic/Documents/MTM%20Transcriptions/Knowledge%20Transfer%20Report%20for%20Dr.%20Michael%20Masnik.docx

If you have any questions, please contact me at 509-375-6528, or Eva Eckert Hickey at 509-375-2065.

Sincerely,

Christine Ross

Christine D. Ross
Team Lead
Energy & Environment Directorate

CDR:ll

Cc w/ attach.: Ryan Whited, Tara O'Neil, Eva Eckert Hickey, Tonya Keller

PNNL-24124

Knowledge Transfer Report for Dr. Michael Masnik

March 2015

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NRC

NUCLEAR REGULATORY COMMISSION

ENVIRONMENTAL ASSESSMENT
REGULATORY REVIEW
TEAM HOME

EARRTH

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1.0 Background

Dr. Michael Masnik has over 40 years of experience assessing the impact of the construction and operation of nuclear power facilities on the environment with an emphasis on aquatic systems. At the time of his retirement, Dr. Masnik was the Water and Ecology Team Leader in the Division of Site Safety and Environmental Analysis, Office of New Reactors (NRO), U.S. Nuclear Regulatory Commission (NRC). His duties as a Team Leader and Senior Aquatic Biologist included the coordination, support, and oversight of NRO activities related to the environmental review of proposed new nuclear power facilities, including reviews of combined license (COL) and early site permit (ESP) applications and other licensing activities in the areas of terrestrial and aquatic ecology and hydrology. As a senior reviewer in the area of aquatic ecology for a number of licensing reviews, he provided assessments of environmental impacts, oversight of contractors and, when required, expert testimony. As Team Leader, he was responsible for assuring that complex issues, such as predicted global climate change, were properly addressed in the NRC's environmental reviews for proposed new reactors in the areas of hydrology and ecology. As the most experienced senior environmental reviewer in NRO, Dr. Masnik invested significant effort in mentoring and training other staff in his areas of expertise.

1.1 Education and Professional Experience

Dr. Masnik's formal education encompassed studies in zoology, aquatic ecology, ichthyology, and evolutionary biology. During graduate school at Virginia Polytechnic Institute and State University (VPI&SU), Dr. Masnik conducted research in a variety of areas; however, he specialized in zoogeography and distribution of freshwater fishes in large river systems. In addition to papers published in those fields, Dr. Masnik published papers on thermal studies on fishes, recovery of damaged aquatic ecosystems, and development of sampling methodology for fish and macroinvertebrates. Dr. Masnik authored or co-authored numerous publications on the above areas.

Prior to joining the NRC, Dr. Masnik served as a consultant, through VPI&SU, for American Electric Power Company; Koppers Company, Inc.; U.S. Army Corps of Engineers; and the Tennessee Valley Authority. He was also employed by Ichthyological Associates as a field biologist investigating the fisheries resources of the Delaware Bay as part of a baseline study for several proposed nuclear stations.

Dr. Masnik joined the Atomic Energy Commission, the predecessor to the NRC, in 1974 as a Fisheries Biologist performing and overseeing National Environmental Policy Act (NEPA) reviews for nuclear power reactor license applications. His principal expertise was in evaluating the impacts of various cooling system designs and intake structures on fish and shellfish in source and receiving waterbodies. In the late 1970s and early 1980s, Dr. Masnik participated in initial licensing reviews for more than 10 sites, 3 alternative site reviews, and investigated numerous environmental events involving aquatic resources at operating nuclear power stations. He also participated as the NRC's representative in the development of U.S. Environmental Protection Agency's (EPA's) draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment (EPA 1977a) as well as the 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements (EPA 1977b). He provided expert testimony at a number of NRC administrative hearings on a variety of environmental topics including shipworms, alternative site reviews, impingement and entrainment, and Shortnose Sturgeon. Dr. Masnik was the lead technical contributor responsible for the development of the NRC staff's practices related to compliance with the Endangered Species Act.

In 1982, Dr. Masnik was appointed as the Technical Assistant to the Director of the Three Mile Island Unit 2 (TMI-2) Program Office for the NRC. For the next 13 years he provided technical oversight on all aspects of the TMI-2 cleanup. He made over 15 containment entries at TMI-2, conducted numerous inspections and surveys, developed custom technical specifications for TMI-2, and oversaw the preparation of three supplements to the programmatic environmental impact statement (EIS) on the cleanup. From 1982 to 1995, Dr. Masnik also served as the Designated Federal Official (DFO) to the NRC sponsored TMI-2 Advisory Panel. During his tenure as the DFO, the panel held over 65 public meetings in the Harrisburg, Pennsylvania area.

In 1997, Dr. Masnik became first Acting, then Section Chief, of the Decommissioning Section in the NRC's Office of Nuclear Reactor Regulation (NRR). Dr. Masnik was responsible for the project management of 19 permanently shutdown reactors. He also oversaw the implementation of NRC's 1996 final rule on decommissioning and the development of the 2002 generic EIS on the decommissioning of nuclear power reactors (NRC 2002).

Dr. Masnik continued to periodically assist the NRC in aquatic impact assessments and compliance with the Endangered Species Act. In the early 1990s, he assisted in the development of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NRC 1996), and the Final Environmental Statement related to the Operation of Watts Bar Nuclear Station Units 1 and 2 (NRC 1995).

In 2001, Dr. Masnik joined the license renewal effort in NRR, again as an expert in environmental impacts assessment. He served as the license renewal environmental project manager for the St. Lucie, Browns Ferry, and Oyster Creek nuclear stations, and worked on numerous other license renewals as the NRC's expert in aquatic and terrestrial ecology and water-intake design. He also was responsible for, or assisted in, formal and informal endangered species consultations for a number of nuclear power stations including Crystal River, Hatch, Saint Lucie, and Turkey Point. He provided oversight in the preparation of the aquatic, and in some cases the hydrological sections, of the supplemental EISs for license

Dr. Masnik next to a Bellefonte cooling tower in April 2007

renewal for the following closed-cycle and once-through nuclear stations: Arkansas, Turkey Point, Saint Lucie, Fort Calhoun, North Anna, Surry, Catawba, Ginna, Summer, Cook, Quad Cities, Millstone, Vermont Yankee, Nine Mile Point, Monticello, FitzPatrick, and Wolf Creek.

In early 2007, Dr. Masnik transferred to NRO to assess the environmental impacts from the construction and operation of new reactors. He developed and presented numerous training modules for both NRC and contract reviewers in the areas of aquatic and terrestrial resources. He developed a new approach for handling Endangered Species Act (ESA) issues with the U.S. Fish and Wildlife Service and the U.S. National Marine Fisheries Service. He provided oversight of the aquatic and terrestrial ecology and hydrology assessments for 11 new reactor applications. Dr. Masnik led teams for five pre-application readiness assessment visits and provided expert testimony for the Vogtle ESP and Levy COL contested hearings, and at the North Anna ESP mandatory hearing. In 2013, he participated in a workshop on environmental impact assessment for the Polish General Directorate for Environmental Protection in Warsaw, Poland.

Throughout his career, Dr. Masnik has actively dedicated himself to mentoring new employees in the area of environmental impact assessment. In the year prior to his January 2, 2015 retirement, Dr. Masnik invested significant effort in knowledge transfer activities so future employees would benefit from his extensive knowledge and experience.

2.0 Introduction

Given Dr. Masnik's extensive experience and long history with environmental reviews, and in support of the NRC's Knowledge Management Program (NRC 2013), it was important to capture his knowledge prior to his retirement. From August 19-21, 2014, Pacific Northwest National Laboratory (PNNL) staff conducted knowledge transfer meetings with Dr. Masnik. The main focus area for the meetings was the assessment of environmental impacts from new reactor licensing. Less focus was allotted to discussions on Dr. Masnik's extensive experience in decommissioning as this knowledge had previously been transferred within the NRC. For this effort PNNL developed a knowledge transfer process, which supports the NRC's Knowledge Management Program (NRC 2006). Appendix A describes this process in detail.

3.0 Process

NRC (2006) and Flanagan et al. (2014) describe the classifications of knowledge in the current literature. This process was developed to elicit three types of knowledge:

1. Explicit knowledge is consciously identified by the outgoing expert and can easily be identified and preserved.
2. Implicit knowledge is not easily recalled by the outgoing expert because it is second nature to them; however, additional subject matter experts at the meeting can help extract this information.
3. Tacit knowledge is cognitive and experience-based knowledge and is more difficult to recall or transfer because it is rooted in practice and experience; however, it can be observed.

The knowledge transfer process used for Dr. Masnik was based on NRC's Knowledge Management Program (NRC 2013). The process was aligned to reflect the applicable steps described in NRR Office Instruction No. ADM-506, Knowledge Management Process (NRC 2007a).

This process is meant as a guide for gathering and documenting information in a way that is consistent with the NRC's Knowledge Management Steering Committee's goals of continually identifying, developing, piloting, and conducting knowledge management projects (NRC 2007b). The key stages of the knowledge transfer process (see Figure 1) were followed and will be discussed in greater detail in subsequent sections.

Figure 1. Key Stages of the Knowledge Transfer Process

3.1 Identify

The first stage in the knowledge management process is to establish a timeline for events (see Figure 2) and identify knowledge areas, meeting format, staff involvement, location, and potential tools or mechanisms for ultimately sharing the information with others.

For Dr. Masnik, it was determined that the most effective meeting format would be face-to-face in an informal setting that spanned a few days, with multiple topics and groups involved to allow a group conversation about previous reviews and Dr. Masnik's accumulated knowledge. This format allowed the opportunity to clarify points and issues as they were discussed.

Meeting participants were carefully selected to elicit as much of the three knowledge types (i.e., explicit, implicit, and tacit) as possible in a 3-day period. Subject matter experts (SMEs) knowledgeable of NRC aquatic ecology reviews were invited to be able to capture as much explicit knowledge as possible. However, participation was not limited to aquatic ecologists. SMEs from related and complementary disciplines (e.g., hydrology, terrestrial ecology, site layout, and facility design) were also invited. The intent was to include SMEs with a strong understanding of the environmental review process that would ask the "why" questions that the aquatic ecologists might not ask because they could consider the information too obvious. The intent was that this strategy would elicit the capture of implicit knowledge that might go undiscussed in the presence of only aquatic ecologists.

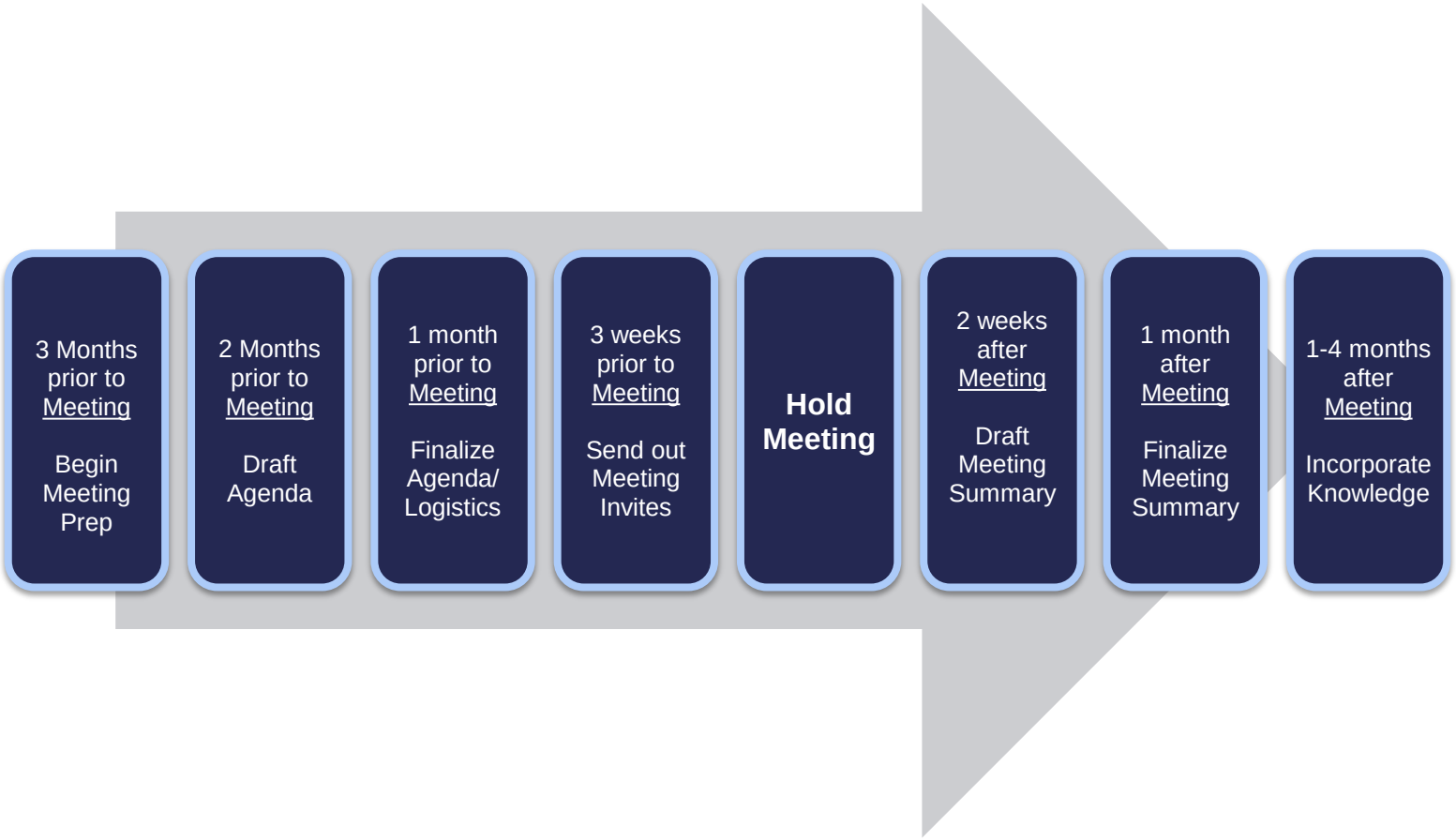

Figure 2. Knowledge Transfer Timeline

Further, SMEs were identified that had worked closely with Dr. Masnik in the past and had observed his approach to environmental reviews. These SMEs were invited to participate in the meetings in an effort to obtain tacit knowledge that Dr. Masnik transmitted largely by apprenticeship, observation, and participation in past environmental reviews.

The following table presents each knowledge transfer meeting attendee or staff member that participated in subsequent knowledge transfer activities (e.g., reviewing notes or compiling reports) along with his or her affiliation, role in the knowledge transfer process, and length of relationship with Dr. Masnik.

Table 1. Meeting Attendees

Attendee (affiliation)	Role	Relationship with Dr. Masnik (years)
Dr. Michael Masnik (NRC)	outgoing expert	
Rebekah Krieg (PNNL)	meeting moderator and aquatic ecology SME	30
Dr. Ann Miracle (PNNL)	aquatic ecology SME	10
Dr. Jeff Ward (PNNL)	aquatic ecology SME	15
Amanda Stegen (PNNL)	terrestrial ecology SMEs	10
Corey Duberstein (PNNL)	terrestrial ecology SMEs	5
Lance Vail (PNNL)	hydrology SME	20
Nancy Kohn (PNNL)	site layout and facility design SME	5
Chris Ross (PNNL)	knowledge management and EARRTH lead	2
Joanne Duncan (PNNL)	designated note-taker	<1

Appendix B provides a copy of the agenda and lists the attendees at each session.

Prior to the meetings, the meeting moderator, Rebekah Krieg, provided the other SMEs with a list of potential topics (Appendix C) to review. The moderator also requested Dr. Masnik's input on the topic list as well as on the meeting format, schedule, and attendees.

The team identified guidance documents, primarily the Environmental Standard Review Plans (ESRPs) and the revision of Regulatory Guide 4.2, as well as numerous Environmental Assessment Regulatory Review Team Home (EARRTH) tools (e.g., Roadmap for Reviews, Team Lead Guidance, and Qualifications Program documents) as the most appropriate target locations for the information from the knowledge transfer. These documents are discussed further in Section 3.4.

3.2 Capture Knowledge

The knowledge transfer meetings were held August 19-21, 2014 in Richland, Washington. The meetings were intentionally informal and meant to be a guided discussion. Agenda items were not necessarily discussed in the order they occurred on the list of potential topics (Appendix C); rather, Dr. Masnik was encouraged to discuss topics as they arose over the course of conversation to facilitate thoughtful dialogue. SMEs were allowed to introduce new topics during the discussions, as applicable, in an effort to elicit implicit knowledge (the "what steps did you take?" type questions) and tacit knowledge (the "why do you do it this way?" type questions). All topics on the agenda were tracked to ensure discussions occurred for each item.

Each day's meeting was recorded electronically using Microsoft Lync. Relevant information was captured and used in this report. The meeting recordings were referred to multiple times during the synthesis of the information shown in this report.

At the end of the meetings, Dr. Masnik provided PNNL with copies of several presentations he had developed during his career.

3.3 Transfer Knowledge

Following the knowledge capture phase, a draft summary report was written and sent to Dr. Masnik and other meeting participants. Dr. Masnik reviewed the first draft of the meeting notes and a meeting summary report and provided comments to the PNNL team on September 19, 2014. Dr. Masnik's comments were used to supplement and revise the meeting notes and the meeting summary report.

The following sections provide examples of the types of information obtained during the knowledge transfer process and how it will be used to shape the future review process for new and existing reviewers and/or the orientation process for new reviewers. While not all inclusive, the following sections demonstrate how the knowledge transfer process was used to address many of the issues and concerns offered by Dr. Masnik.

3.3.1 Conceptual Framework

Dr. Masnik expressed that his primary concerns related to the development of EISs were whether every issue was considered and whether reviewers were able to correctly predict impacts at the sites. He emphasized that a clear understanding of the physical effects of the nuclear power facility on the resource, and a clear understanding of the resource and its location in relation to the areas affected by the facility are necessary to ensure that reviewers are not missing important information. After considerable discussion of this issue, Dr. Masnik concluded that one of the best ways to ensure that reviewers are able to attain this clear understanding is to develop a conceptual portrayal of the system such as a food web, possibly combined with or considered with a flow diagram showing the movement of water in the habitat and into and out of the facility. This was termed a "conceptual framework." The goal of a conceptual framework is to illustrate in a simple manner how the actions of building and operating the facility will affect the aquatic resources. It also provides a method to communicate with, and document environmental effects for, other stakeholders. Understanding the interrelationship between the plant and the resource improves the ability of reviewers to account for relevant parts of the review. Even in cases where data may be missing, reviewers can sometimes use a conceptual framework to indicate that the potential for an impact was considered.

This process-related knowledge is an example of implicit knowledge because it is fact-based but not easily recalled by the knowledge expert without supportive discussions with the SMEs in attendance.

Aquatic reviewers have an established understanding of the issues for conventional closed-cycle cooling systems on conventional East Coast rivers or waterbodies, and it is unlikely that

they would fail to consider an important impact to the aquatic resource. However, outside this area, with new types of reactors (e.g., small modular reactors) or complicated hydrological systems, more time should be spent during the initial review considering potential impacts. While it may not be feasible to anticipate all possibilities in adequate detail to write guidance into an ESRP, aquatic ecology reviewers should be encouraged to develop conceptual models based on brainstorming with other aquatic ecologists and related SMEs (e.g., hydrologists and terrestrial biologists). The focus of their discussions should include answering the following questions:

- How is this plant different?
- How is the site different?
- What is unique about the resources?

It is incumbent on reviewers to develop the conceptual framework for understanding the environmental system as a whole, inclusive of biotic and abiotic factors. The team determined that the COL application for Turkey Point Units 6 and 7 (NRC 2015) is a good example of how a conceptual framework was necessary to help with a number of issues. For the Turkey Point COL, the water supply is atypical, has a completely redundant alternate water cooling system, and the new reactor station discharges are proposed to be via deep well injection. This type of discharge has not been considered prior to this application in the regulatory sphere as other licensed power plants dispose of liquid and gaseous wastes to surface water, and the current regulations do not provide guidance for reviewing effects from the discharge of liquid wastes via this technology.

The Turkey Point COL further benefitted from the development of a conceptual framework in that the new plant will use industrial water (gray water) in its cooling towers. Some of the drift from the towers will settle on land under the jurisdiction of the National Park Service and critical habitat for the American crocodile. Pharmaceuticals and contaminants of concern not completely removed during wastewater treatment could potentially be deposited in the environment due to drift from the cooling towers and potentially become concentrated in nearby waterbodies. Another complication in this analysis is that the science has not been developed to the degree to enable understanding of what happens to the gray water metabolites in the environment. Likewise, the entire list of the compounds that could potentially be present in the cooling tower drift is unavailable because of the overwhelming number of existing and new chemicals potentially present in gray water. In addition, the effect of tertiary treatment of cycles of concentration for new compounds is unknown. The use of a conceptual framework is critical to help to identify the extent of potential effects from this cooling-water source, and serves as an example of a cooling-water resource that may become more commonplace as water becomes a scarcer resource and as utilities look at innovative ways to use water or reuse water.

The Turkey Point COL review is an example of how the conceptual framework can be used to identify areas of uncertainty. EISs should be written in a way that explains to the public what and how much uncertainty is in EIS impact determinations.

3.3.2 Expertise

Dr. Masnik indicated that the reviews would benefit from having reviewers familiar with multiple resource areas—specifically hydrology, aquatic ecology, and terrestrial ecology. For example,

an aquatic ecologist should understand basic hydrology concepts. Likewise hydrologists need to understand some ecology. Reviewers should be comfortable enough in hydrology and terrestrial and aquatic ecology that they can make contributions to the understanding of the conceptual frameworks built in the other disciplines. Options for cross training in other disciplines include reviewing previous workshop presentations. In addition, if reviewers work together on a conceptual framework, their mutual understanding will be clearer. The discussion of expertise and the need to work with and across discipline lines is considered to be tacit knowledge. The SMEs in the meeting acknowledged that Dr. Masnik embodied this practice to a greater degree than anyone else.

Dr. Masnik also indicated a need for expanded expertise in evolving issues such as those surrounding the use of reclaimed water. He viewed this as a potentially important review area in the future for licensing because, as discussed in the previous section for the Turkey Point COL review, the future uses of reclaimed water at closed-cycle plants will result in the discharge of blowdown to surface water. New research is emerging, but only a small amount of literature exists on this subject. Reviewers need to be familiar with the results of the research as it emerges.

3.3.3 Definitions of Aquatic Resources and Important Species (and how they tie into the definitions of vicinity and geographic area of influence)

Dr. Masnik expressed concerns about the consistency with which reviewers define aquatic resources. In EISs, impact level reviews are tied to the resource. However, the definition of the resource is complicated, especially because NEPA looks at the population and ecosystem, but the reviewers must also consider individuals under the ESA. The definition of the resource needs to be very clear. Reviewers need to think of a resource in relation to the ecosystems and focus on populations, unless they are specifically considering the ESA and must focus on the individual.

The proposed location of the facility is important in the definition of the resource. If a facility is located at the edge of the range of a common species, that species may be considered rare where new units are proposed. In that case, reviewers need to decide whether to be concerned about the impacts to the population. In some cases, the species may be considered State endangered yet plentiful elsewhere in its range.

In addition to defining the resource, the definition used for the vicinity and the geographic area of interest will also affect the determination of the impact level. The vicinity is where the direct and indirect effects from the construction and/or operation of the facility occur. Factors that need to be considered include how far the runoff or discharge will travel during construction and how far the salt deposition from the cooling towers extends. The determination of the vicinity is based on where the effects hit the threshold between the “signal” (effects from the plant) and the noise (where the effects from the plant can no longer be discerned). The vicinity may be defined differently at different sites. The vicinity for aquatic ecology may be linear for a site located on a river, but not for a site on an ocean, reservoir, or lake.

The geographic area of interest is used in the cumulative analysis. The definition of the geographic area of interest also affects the impact level determination. If a specific type of habitat affected by construction is abundant in the geographic area of interest, then the impact

level will likely be lower than if the habitat is unique. For aquatic systems, the geographic area of interest could follow along a watershed for a plant located adjacent to a river, rather than being defined as a circumference around the site. The geographic area of interest could be influenced by the individual species, food web, or even habitat.

Dr. Masnik indicated that, in a sense, reviewers are looking at the ecological function of the species when determining the geographic area of interest. Reviewers should consider whether the resource is altered as well as whether ecological function is lost. Loss of functionality is different for wetlands than it is for streams.

Dr. Masnik emphasized that reviewers must determine what makes a species or habitat important, and whether that species or habitat is unique or has value to the public. A specific definition of "important species and habitats" is currently used for reviews, but Dr. Masnik expressed the concern that the number of species that are described and discussed in the EISs is so extensive that it takes the focus off the impacts to the ecosystem as a whole, and potential loss of ecological function. Dr. Masnik recommended that reviewers clearly define the area that can be influenced by the impact and then select a subset of species in that area considered important to the ecological system. A statement such as "in this EIS, the environmental resources will be represented by this subset of species that staff believes has importance in this system" may be more appropriate for the EIS. For example, a review on the Hudson River identified over 200 species, but only 18 to 20 were chosen as meaningful components of the food web. The assumption was made that those 18 to 20 species were benchmarkers for the impacts on the river.

Dr. Masnik and his colleagues discussed the basis for determining the important species and habitats and whether the table of important habitats and species currently in the ESRP should be revised. The following items should be considered in the determination of important habitats and species.

- Multiple species that are similar in lifestyle, habitat, and reproduction do not need to be included in the description of important species. One typical species could be described and evaluated in depth and the remaining species could be simply mentioned.
- States frequently have long lists of rare species. The State environmental resource office can provide information on which species are most important from their viewpoint.
- Reviewers can query the State as to the value or uniqueness of a habitat, because the criteria used to identify valuable habitat varies from state to state. Some states indicate value by habitat type, some states rank different types of streams and the ecological functions associated with those streams, and some states have require that no streams be destroyed.
- Reviewers can ask the applicant why specific streams or habitats were considered important enough to include in the environmental report (ER).

3.3.4 Hydrology Discussions in Aquatic Ecology

Dr. Masnik and various SMEs in the meeting indicated that the staff needs to reconsider how they discuss flow rates in the EISs. There needs to be an acknowledgement that variable flows during the year are normal and a discussion of the flow regime in terms of "normative flow." In

some cases (e.g., North Anna) the State is requiring a change from “normative” to something “constant” where there are no low flows and no high flows. Reviewers need to understand that this is not how aquatic ecosystems usually work. Droughts and floods, although infrequent, are “normative.”

3.3.5 Impact Levels

Dr. Masnik also provided his thoughts related to the determination of impact levels. He indicated that reviewers must take a reasonableness approach on the determination of the potential for impacts. Reviewers need to determine what they believe to be a reasonable impact and then discuss it with their peers and listen to the public. To a large extent, discussions regarding the determination of impact levels improve the process.

The impact levels are used to define whether the environmental effects are SMALL (so minor that they will neither destabilize nor noticeably alter any important attributes of the resource), MODERATE (sufficient to alter noticeably but not destabilize important attributes of the resource), or LARGE (clearly noticeable and sufficient to destabilize important attributes of the resource). The key to determining the impact level is first determining what an important attribute is. Habitat, species, or overall ecological function could be considered as important attributes. However, the definition of the attribute and the area of interest are also important because the measurement of impact is basically a signal to noise question. If you choose too small of an area the proposed project will appear to have a LARGE impact because the resource may appear to be unique. If you look at too large of an area for evaluation then the proposed project may appear SMALL if the resource is not unique in that area.

An example that Dr. Masnik provided is that elimination of a stream or waterbody on the project site during construction would not be considered a MODERATE or LARGE impact unless the stream or waterbody had unique attributes considered to be of value that were not found in other areas in the geographic region. Typically, there are thousands of acres onsite, but only a couple of hundred acres for the plant that are permanently affected. However, Dr. Masnik reiterated that it is important to describe the affected area, and discuss the temporary and permanent effects on the site for the public.

3.3.6 National Pollutant Discharge Elimination System (NPDES) Phase I and Phase II Regulations

Dr. Masnik discussed the applicability of conformance with EPA regulations on the design and operation of cooling-water-intake structures. The Phase II rule for new units at existing facilities is unlikely to be applicable to new reactors (although there may be exceptions) so the focus should be on the Phase I rule. Based on these regulations, Dr. Masnik recommended revisions to the current staff guidance (i.e., ESRPs) to focus the aquatic analysis in Chapter 5, Operations, to determine if the Phase I requirements for intake flow and through screen intake velocity are met. The expectation is that, if a utility complies with the Phase I rules on technology and flow limitations, then it is protective of the aquatic resource with regard to impingement and entrainment. Nevertheless, reviewers still need to perform an in-depth analysis to determine if there is anything distinctive in regards to the site that would cause impingement or entrainment rates of important species, or any changes in ecological function

despite meeting the Phase I requirements. This could include the analysis of impingement and entrainment data from other units on site or in the vicinity.

This is an example of explicit knowledge combined with implicit knowledge. The NPDES regulations are codified and, as Dr. Masnik pointed out, revisions were needed to include the new regulations in regulatory guidance documents. However, the need to perform an in-depth analysis of distinctive attributes related to the site is an example of implicit knowledge because it is process-related.

3.3.7 Writing the EIS

Dr. Masnik stressed the importance of basing EIS sections on information that is complete and correct. Reviewers cannot assume that all the information they need is provided to them during the pre-application visits or even within the ER. In addition, major changes in a system or in the design of the plant are often made during the review process. One example of a major change in the design of the plant during the review process is Pond C at the Lee Nuclear Station site. A second example is from Turkey Point, where initially the applicant indicated it was going to use reclaimed water as its primary source of makeup water and water from a radial well farm for a period of 3 months each year as a backup water source. The operational plan for the backup water supply continued to change over the course of the review, and reviewers had to continue to request information until they received answers. Future reviewers should be encouraged to be persistent in their drive to understand the project early in the review cycle so that they can appropriately describe the action and determine its impact on the environment.

Dr. Masnik also indicated a need to encourage reviewers to write the EIS as if they were addressing issues that might surface during a hearing. If EIS sections are not clear and concise, explaining the project and action during a hearing will be difficult. It is important that EIS reviewers be able to defend their impact levels and identify any tradeoffs that may result from the action.

3.3.8 Reviewing Three Mile Island Experiences

As described in Section 3.1, it was determined that the main activities of the knowledge transfer meetings would focus on environmental effects from new reactor licensing, and that the technical aspects of the cleanup of TMI-2 had been thoroughly documented previously. However, Dr. Masnik did review much of the information that he and others had previously developed or saved related to the TMI-2 recovery and cleanup as well as documents, photographs, and videos that were then transmitted to the NRC historian's office.

3.4 Share and Communicate

As indicated in Section 3.3, a meeting summary report was prepared to communicate and share the knowledge obtained during the knowledge transfer meetings with Dr. Masnik. As discussed previously, the team had already planned to incorporate the knowledge transfer information into formal NRC guidance documents such as the ESRP and EARRTH tools (e.g., Roadmap for Reviews and orientation documents). The summary report highlighted information that could be included in each of those resources. Dr. Masnik had been a mentor to many of the ecologists,

including NRC staff and contractor staff, working on environmental reviews for the NRC. Thus, it was very important to ensure that the information obtained during the knowledge transfer process was preserved in a manner that would allow current and future reviewers access to his insights and recommendations. To ensure the widest use of the information, a multi-tiered approach was used to disseminate the information to current reviewers and preserve it for future reviewers. The following subsections refer to the information collected and described in Section 3.3 and discuss how the information has been, or will be, incorporated into the ESRPs, EARRTH Tools, and Qualifications Program for use by current and future reviewers.

3.4.1 Formal NRC Guidance Documents

Formal NRC guidance documents, such as the ESRPs and regulatory guides, set the basis for the reviews of applications for new nuclear power facilities; thus, updating these documents with information from the knowledge transfer meeting was a high priority.

3.4.1.1 Aquatic ESRP

In late summer 2014, the NRC and PNNL staff initiated a project to revise the ESRPs to reflect changes in NRC policy, regulations, and guidance as well as to capture the NRC staff's experiences from previous application reviews and participation in judicial and administrative hearings. The aquatic ESRP was selected as a pilot for the revisions of the ESRPs. This selection proved to be well coordinated with the timing of the knowledge transfer process for Dr. Masnik. Following the consolidation of the notes from the knowledge transfer meetings, the team working on the ESRPs identified appropriate changes in the ESRP review process. Dr. Masnik was asked to comment on the aquatic ESRP, as were two other aquatic ecologists that attended the knowledge transfer meeting and one aquatic ecologist that did not attend the meeting. These reviews provided confirmation that the necessary ESRP revisions had indeed been incorporated. Dr. Masnik's availability to provide clarification and further details on information included in the ESRPs was invaluable to ensuring the accurate capture of the information. As discussed in Section 3.3, multiple areas in the aquatic ESRP were identified for revision based on Dr. Masnik's knowledge base and experiences.

Conceptual Framework

Information related to the development of conceptual frameworks was included in the aquatic ESRP in the following locations:

- the discussion of data gathering in the project process section—to provide the reviewers with an understanding of the need to incorporate the development of the conceptual framework into the project process
- the discussion of drafting the EIS—to encourage coordination with other resource reviewers in the development of the conceptual framework for determining the aquatic resources affected by the proposed action
- the discussion of the review activities, guidance, and conclusions—to instruct the reviewers that the development of a conceptual framework is an iterative process and dynamic characterization and to stress the importance of developing a conceptual framework to

determine which aquatic resources will be affected in relation to the areas affected by the facility

- the discussion of the use of the conceptual framework—to focus the review of species to those most likely to be affected by the project.

Definitions used in the EISs

Information related to important species and review area definitions was included in the ESRP in the following locations:

- the discussion of background information in the ESRPs—to assist reviewers in clearly defining the resource, vicinity, and geographic area of interest
- a revised important species table
- guidance related to discussion of important species and habitats.

Hydrology Discussions in Aquatic Ecology

Information related to the importance of aquatic ecology reviewers coordinating information review with surface water hydrology reviewers (e.g., normative flows and varying flow conditions) was included in the aquatic ecology section to provide guidance for authors writing EIS sections.

NPDES Phase I and II Regulations

Information related to current NPDES regulations and, specifically, how aquatic reviewers should consider supporting information in context was included for the aquatic ecology section related to the analysis of impacts in the EIS:

- Incorporation of Phase I regulations in the analysis of operational impacts related to entrainment and impingement for new cooling-water intakes. The expectation is that if a utility complies with the Phase I rules on technology and flow limitations then it is protective of the aquatic resource with regard to impingement and entrainment.
- Description of differences between Phase I and Phase II regulations.

Writing the Aquatic ESRP

Information related to the writing the aquatic ESRP included the following:

- The need to provide clarification of EIS review expectations and guidance related to the best practices for using and reviewing the ESRP.
- An indication that aquatic reviewers should be familiar with Chapter 3, even if they do not contribute to that chapter.
- A discussion of how reviewers should write and dovetail their writing with areas written by other reviewers, specifically Chapter 3.
- An indication that reviewers should understand the interplay between issues in different resource areas even before beginning to draft their sections. Reviewers should provide

hydrologists with a clear context so the biological discussion dovetails with the hydrological sections. It is important to discuss the interplay with the other reviewers.

- An indication that the operational issues in Chapter 5 include all operations and structures that interface with water communities, not just the cooling system.
- A recommendation that aquatic reviewers hold discussions with other reviewers to ensure agreement regarding the appropriate number of linear miles of streams or length of transmission lines.
- A recommendation that reviewers refer back to previous sections where specific numbers originate (e.g., "as described in Section 3.4 – the intake is XX ft wide by XX ft high."
- A reminder that the data gathering is often iterative. Reviewers need to understand the need to circle around on the information for longer reviews. For instance, when the review process spans several years, new monitoring data could become available, and new species may be listed. Turkey Point Units 6 and 7 and Watts Bar Unit 2 are good examples of longer reviews.

3.4.1.2 Regulatory Guide 4.2

The knowledge transfer process incorporated Dr. Masnik's knowledge for ESRP revisions that were compatible with the newest draft revisions to Regulatory Guide 4.2, which provides guidance to new reactor applicants for the preparation of ERs. Changes made specifically to the table of important species for the terrestrial and aquatic ecology ESRPs as a result of the knowledge transfer were used to update Regulatory Guide 4.2 ecology sections. Dr. Masnik was able to review the proposed revisions to Regulatory Guide 4.2 prior to its finalization.

3.4.2 EARRTH Tools

Specific EARRTH tools, such as the Roadmap for Reviews, are used by reviewers to assist them in understanding the review process and expectations. These EARRTH tools contain information that would not be considered strict review guidance, but rather suggestions or recommendations for conducting successful reviews. EARRTH tools also contain links to other information, and will be updated to include relevant links to Dr. Masnik's presentations.

3.4.2.1 Roadmap for Reviews

The Roadmap for Reviews is an EARRTH tool reviewers use primarily to provide background information on each stage of the review and lessons-learned information that will help them successfully navigate through each stage of the review process. In addition, the Roadmap for Reviews provides links to useful templates and documents that will assist members of the team in collaborating and communicating with external agencies and documenting their review process.

The following insights from Dr. Masnik related to obtaining information will be added to the Roadmap for Reviews:

- Instructions for reviewers related to discerning which details are important and which details are not important.

- Information regarding the proper instances to push for an answer. Sometimes information is critical to determining an impact level and sometimes an alternative process should be developed.
- Suggestions on how to tactfully and respectfully respond to comments, particularly comments related to so-called unreviewed impacts.
- Because a tremendous amount of information needs to be transferred from the utility, it is important to be able to obtain the perhaps 10 percent of the total information not transferred as a matter of course by the environmental report (ER) or the requests for additional information (RAIs). Information still missing towards the end of the review is often available in other documents and writing an RAI is not necessary. Frequently the applicant knows where the information is located and can point the reviewer to the information.
- A reminder that although the information in Regulatory Guide 4.2 may not cover all situations, reviewers should understand that referring back to Regulatory Guide 4.2 and other appropriate Regulatory Guides is a good way to document the need for specific information.
- A reminder that reviewers must understand that there may be appropriate times and methods for writing around specific data gaps. For example if an area is referred to as 1,600 acres and later as 1,616 acres (and the measurements are not critical), the number could be referred to as “approximately 1,600 acres” or “less than 1,650 acres.” This may also be the case when the applicant is not able to obtain specific details such as the details of a large component transport route when the exact route will not be used for many years and the routing will likely change during the years. In some cases reviewers will need to decide if it is appropriate to discuss potential impacts rather than specific impacts.
- A recommendation that reviewers look at some of the more recent NRC-issued EISs for depth and diversity of coverage. Reviewers should also look at examples using a similar ecosystem.

Options were discussed regarding how to improve the quality and completeness of the applicant’s ER. Ideas included the following:

- improving interactions with licensee SMEs or contractors that develop the ER, because they have the best understanding of the site and the details of the proposed station
- obtaining more information during pre-application visits
- discussing with the utility the need for more complete information earlier and putting an emphasis on obtaining that information during the pre-application stage.

Lessons learned regarding a conceptual model include the following:

- Early in the review, possibly even in the pre-application stage, reviewers should hold a meeting to identify what is unique or different about the project. This meeting should focus on the new and innovative approaches the utility is using—especially those outside NRC experience. The meeting should also discuss water balance, and all reviewers affected by water balance, including the hydrologists and ecologists, should be involved.

- Development of a conceptual model needs to be an iterative process. Reviewers need to look at the potential for an effect from the construction or operation of the facility and determine how it could impact the organisms present on, or in the vicinity of, the site. Reviewers should work together to decide if each potential impact is realistic and if an appropriate degree of detail is being considered.
- Conceptual models (and their corresponding reviews) work best when reviewers have a good understanding of both their own resource areas and related resource areas.

3.4.3 Update to Qualifications Programs

Future activities will include updating the contractor and NRC staff qualifications programs for environmental reviews. These programs are focused on helping new reviewers obtain an understanding of the review process using background information that includes high-level process and specific guidance from the ESRPs and NRC regulations. The following information from the knowledge transfer meetings with Dr. Masnik will be added or updated in the respective qualifications programs.

- Retain a focus on the hearing process. Dr. Masnik indicated that the questions from the Atomic Safety and Licensing Board and the Commission provided him with a new appreciation for how to write future EIS sections in a manner that allows reviewers to defend what they wrote. He recommended that new reviewers read the list of questions from the Atomic Safety and Licensing Board and the Commission, and watch videos of the hearings to gain an understanding of the importance of following the review guidance.
- Recognize the need to defend, in detail, EIS content.
- Identify tradeoffs. Reviewers must be clear about impacts and indicate that there will be some effects.
- Understand the importance of clearly defining the process and the logic used to reach conclusions.
- Pay attention to the ESRPs. Hearing judges go back to the ESRPs and look to see that everything has been covered. They do the due diligence to match up the ESRPs with EIS sections. It is important that reviewers carefully consider and follow the ESRPs.
- Thoroughly document all work, including conclusions.

4.0 Summary

Conducting the knowledge transfer process for Dr. Masnik proved to be a valuable and successful activity. His historic knowledge and expertise was captured and will be communicated and shared with current and future reviewers who may not have had the experience of being mentored by Dr. Masnik. His knowledge will be incorporated into formal NRC guidance documents (e.g., the ESRPs and Regulatory Guide 4.2), the contractor and NRC staff qualifications programs for environmental reviewers, and EARRTH tools.

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Appendix A

Knowledge Transfer Process

A.1 Introduction

The U.S. Nuclear Regulatory Commission (NRC) Office of New Reactors (NRO), Division of Site Safety and Environmental Analysis, has invested significant resources in developing and maintaining a project and knowledge management (KM) system in support of environmental reviews for new reactors. This system, the Environmental Assessment Regulatory Review Team Home (EARRTH) is adaptable and is being used to meet the needs of other NRC offices for environmental and safety work. EARRTH contains project and KM tools and houses knowledge from a multitude of subject matter experts. EARRTH has diverse capabilities; however, the most common uses include the following:

- collaboration and communication
- project management
- document production management
- reference management
- records management
- hearing support
- comment response management
- knowledge capture and transfer
- stepwise guidance for Environmental Project Managers
- team lead and subject matter expert guidance.

EARRTH is maintained by Pacific Northwest National Laboratory (PNNL). Users include NRC and PNNL staff, other Federal agencies (e.g., U.S. Army Corps of Engineers), other national laboratories (e.g., Oak Ridge National Laboratory and Argonne National Laboratory), and commercial contractors. EARRTH is constantly growing and evolving, and has been leveraged by, and customized for, other NRC organizations including the Waste Confidence Directorate, the Office of Nuclear Material Safety and Safeguards, and the Office of Research.

Knowledge capture and transfer is an important function of the EARRTH site and the process aligns with the NRC's KM Program definition and objectives (see Figure A-1) (Flanagan et al. 2014). The NRC has recognized the importance of capturing knowledge from experienced individuals who are retiring or moving on to other work in an effort to communicate and share information across the agency (see Figure A-2). SECY-06-164 (NRC 2006) and Flanagan et al. (2014) describe the classifications of knowledge in the current literature:

1. Explicit knowledge is consciously identified by the outgoing expert and can easily be identified and preserved.
2. Implicit knowledge is not easily recalled by the outgoing expert because it is second nature to them; however, other subject matter experts at the meeting can help extract this information.
3. Tacit knowledge is cognitive and experience-based knowledge and is more difficult to recall or transfer because it is rooted in practice and experience; however, it can be observed.

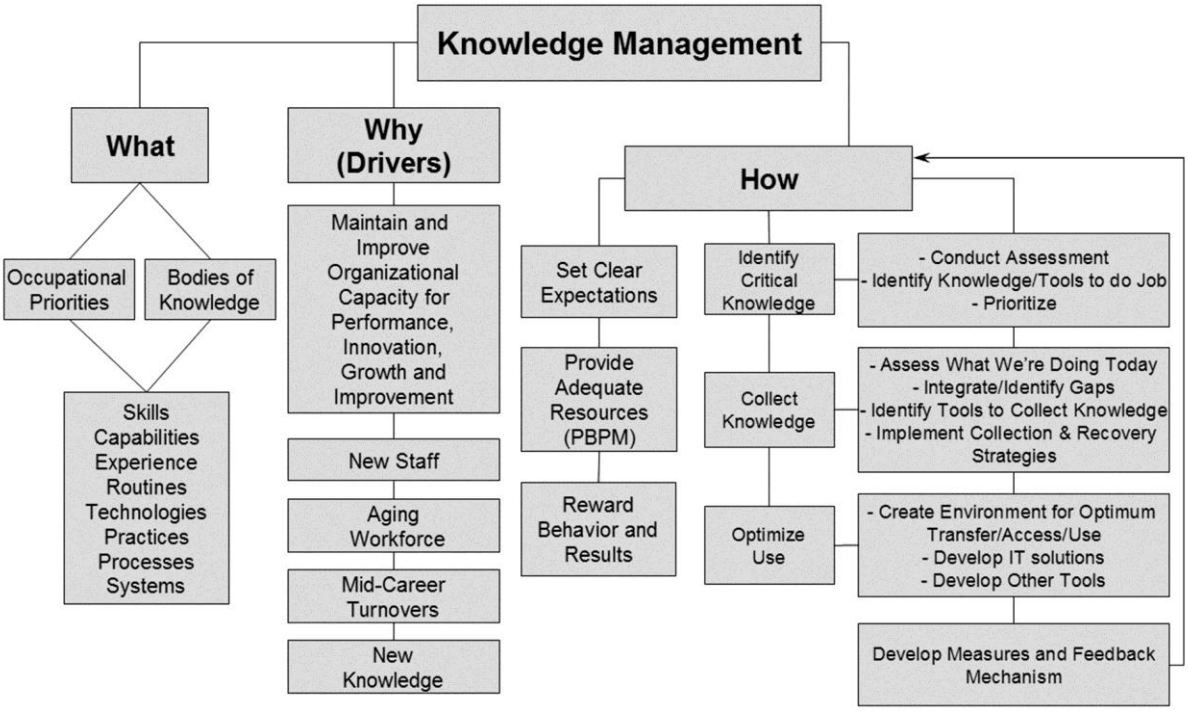

Figure A-1. Overview of the NRC KM Program (NRC 2006)

In late 2014, EARRTH was used to capture knowledge from Dr. Michael Masnik. It was important to capture Dr. Masnik's knowledge in a way that it could remain accessible for senior staff and shared with junior staff and any new staff that would benefit from Dr. Masnik's experience. This document describes the processes followed to capture Dr. Masnik's experience and to transfer that knowledge into regulatory guidance documents, qualification programs for technical reviewers, and other EARRTH tools that will be used by subject matter experts on future environmental reviews.

From SECY-06-164 (NRC 2006):

"The NRC is a knowledge-centric agency that relies on its staff to make the sound regulatory decisions needed to accomplish the agency's mission. In the recent past, the agency has enjoyed a stable workforce and a climate of slowly-evolving technologies that has allowed it to meet its performance goals by using an informal approach to KM. That environment has changed and the agency must now institute a systematic approach to KM that can support the faster rate of knowledge collection, transfer, and use needed to accommodate increased staff retirements, mid-career staff turnovers, the addition of new staff, and the broader scope of knowledge needed to expand the agency's knowledge base to support new technologies and new reactor designs."

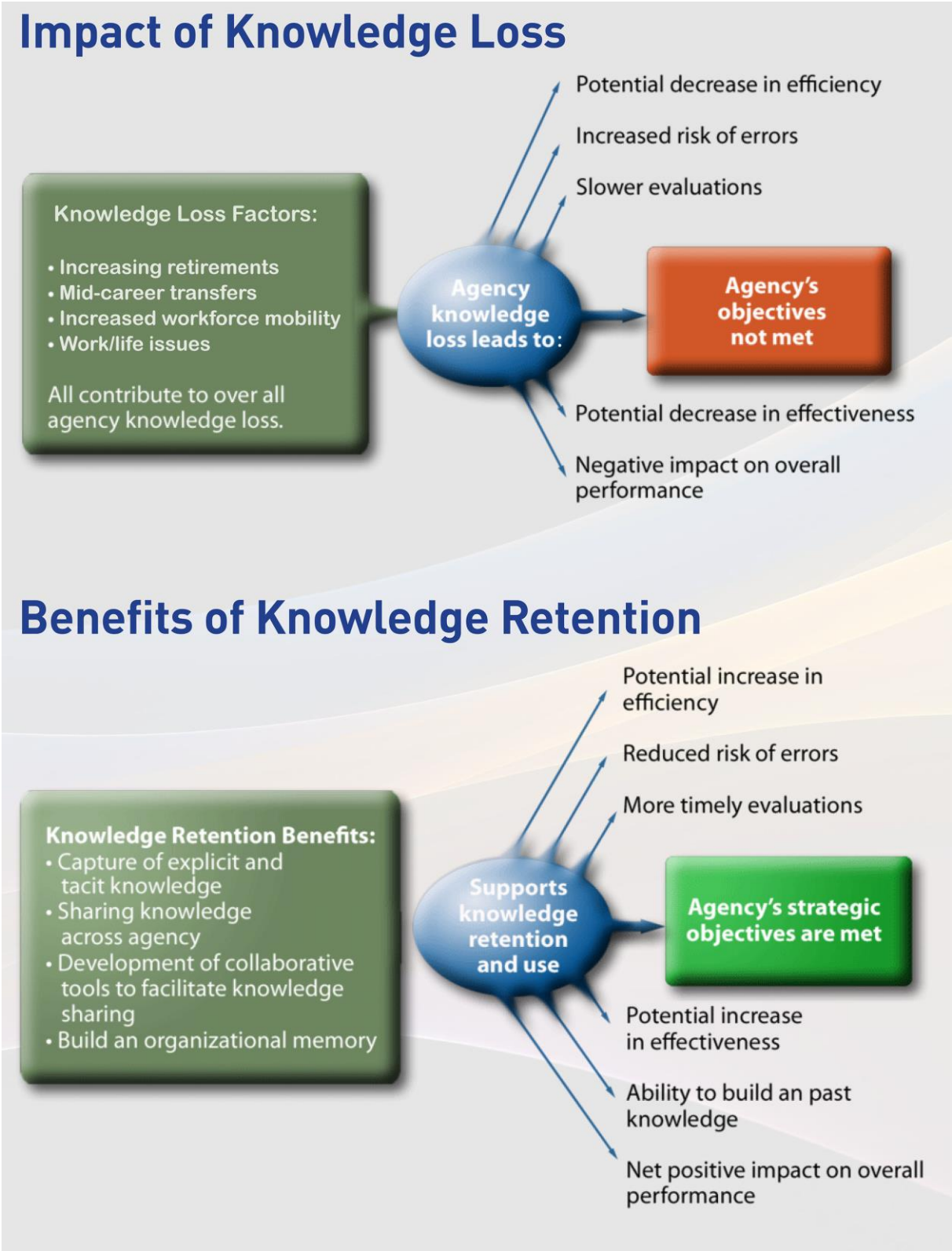

Figure A-2. Impact of Knowledge Loss and the Benefits of Knowledge Retention (modified from NRC 2013)

A.2 Process

The knowledge transfer process described below was developed based on NRC's Knowledge Management Program (NRC 2013). This process was designed to elicit three types of knowledge: explicit, implicit, and tacit (as defined in Section A.1). The process was aligned to reflect the applicable steps described in Office of Nuclear Reactor Regulation (NRR) Office Instruction No. ADM-506, Knowledge Management Process (NRC 2007a). This process is meant as a guide for capturing and sharing information in a manner consistent with the NRC's Knowledge Management Steering Committee's goals of continually identifying, developing, piloting, and conducting KM projects (NRC 2007b)

Figure A-3 summarizes the key stages of the knowledge transfer process (i.e., identify, capture knowledge, transfer knowledge and share and communicate). Each stage is discussed in greater detail in subsequent sections.

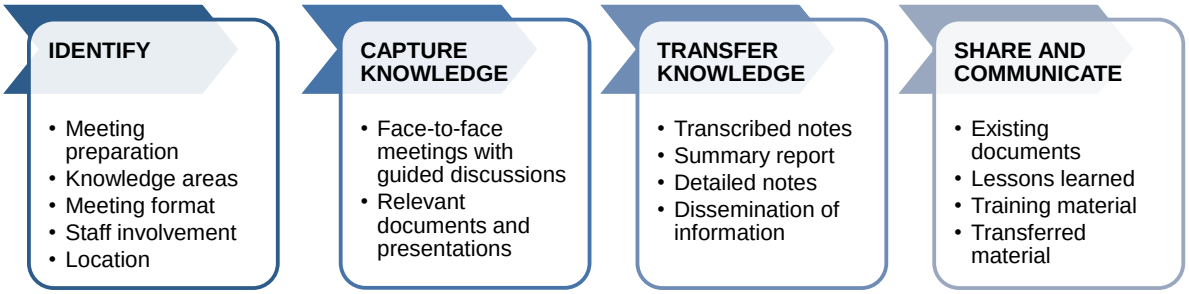

Figure A-3. Key Stages of the Knowledge Transfer Process (modified from NRC 2007a)

In accordance with this process and to minimize confusion, the following titles are used throughout this document:

- outgoing expert – individual identified as having knowledge in need of being transferred before retirement or role change
- meeting moderator – individual tasked with coordinating meeting logistics, providing the agenda and expectations for the meeting, and facilitating the meeting
- designated note-taker – individual tasked with taking notes and preparing the meeting summary
- subject matter expert – individual or individuals participating in meetings to ask questions and extract pertinent and applicable information.

A.2.1 Identify

The first stage in the KM process is to identify the subject matter expert, the type of knowledge that will be captured, the ultimate recipients for the knowledge transfer, and the potential tools or mechanisms for ultimately sharing the information with others. The identification process should also include a timeline for events (Figure A-4) that includes establishing a framework for activities needed for initial preparation, a list of topics for transfer, determining meeting logistics, identifying participants for the transfer event, and checking final meeting preparations. The

following recommendations were developed based on the experience and lessons learned from the knowledge transfer exercise with Dr. Masnik.

A.2.1.1 Initial Preparation

Initial preparation for knowledge transfer begins with identifying a framework that includes considering meeting preparation issues and identifying knowledge transfer subject areas and recipients. Meeting preparation should begin at least 3 months prior to the meeting to allow the outgoing expert sufficient time to review and provide input on the agenda and proposed schedule, gather any relevant materials, and identify attendees. At least one of the individuals attending the knowledge transfer meeting should have worked closely with the outgoing expert, in order to assist in identifying topics and in providing context during the discussions and the "share and communicate" stage. An offsite location is recommended to allow participants to focus on the knowledge transfer. An agenda should be developed iteratively so the outgoing expert and related subject matter experts have time to refine the final agenda. In addition, the meeting organizer and the outgoing expert should give some initial thought to any materials (e.g., presentations or documents) that may be useful to preserve and that should be brought to the meeting.

A.2.1.2 Topics for Transfer

Two months prior to the meeting, knowledge transfer topics should be identified and a preliminary agenda should be drafted (see Appendix B). The outgoing expert should be prompted to suggest topics for discussion and items that can be collected during the transfer. Examples include the following:

- documents important to decision-making or overall knowledge (e.g., NRC/other Federal agency guidance documents and regulatory guides)
- important contributions from workshops or presentations
- current hot topics
- lessons learned from specific experiences
- importance of integration and coordination with other resource areas.

As the agenda is being refined, the meeting moderator and outgoing expert should discuss which documents should be brought to the meeting for transfer, sent by e-mail, or uploaded to EARRTH. The probable topics should also be considered in terms of how the information will be used and shared and communicated with others. For each topic, it is important to identify the target outcome for the knowledge transferred during the meeting. The outgoing expert should be allowed sufficient time to review the final agenda and gather materials in preparation for the meeting.

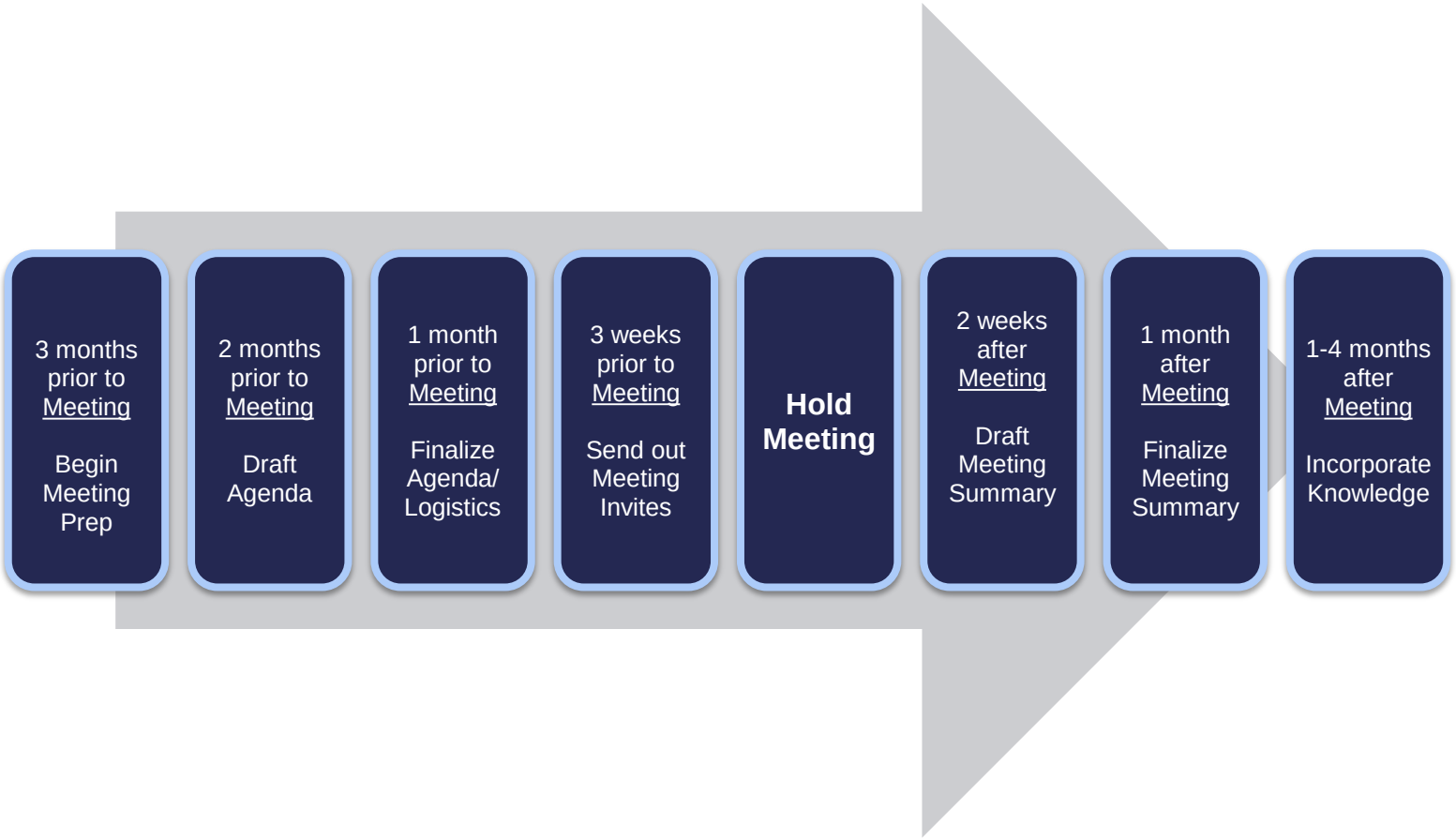

Figure A-4. Timeline of Knowledge Transfer Process

A.2.1.3 Meeting Logistics

One month prior to the meeting the agenda should be finalized, including the location and the number of days required (with allowances for sufficient discussion time and breaks throughout each day) (see Appendix B). Based on the successful knowledge transfer meetings with Dr. Masnik, it is recommended that more substantial knowledge transfers span multiple days with three or four 1.5 to 2 hour blocks of time established each day for specific topics. Meetings should be conducted in person, with minimal participation by remote technology. The meeting location should be able to accommodate the number of participants comfortably and have the necessary audio/visual support for the meeting. Daily meeting participants may vary based on the subject matter area and complexity of the topic.

A.2.1.4 Participants

Participant selection is very important. Participants should be familiar with the content of the subject area, have similar and/or shared working experiences with the outgoing expert, and be invested in the knowledge transfer process. In some cases it may be valuable to bring in subject matter experts with tangential, but different backgrounds (e.g., hydrologists and terrestrial ecologists for discussions on aquatic ecology). A moderator should be identified to keep the agenda on track and may also serve as the overall knowledge transfer coordinator. In addition, staff that worked closely with the outgoing expert should be considered as participants to provide synergy, to assist the outgoing expert in remembering details and events, and to elicit as much implicit and tacit information from the outgoing expert as possible. Finally, a designated note-taker should be identified to record and provide written notes of the discussions and capture the raw information during the meetings. If the meeting is being recorded, participants should be informed and, if necessary, sign a release prior to the meeting.

A.2.1.5 Check Final Preparation

Three weeks prior to the knowledge transfer event, the outgoing expert should take the following steps:

- ☐ review the agenda
- ☐ prepare information for discussion topics
- ☐ gather relevant material.

The meeting moderator or event coordinator should take the following steps:

- ☐ review the agenda and share it with invited participants
- ☐ send the final agenda and detailed expectations to the outgoing expert
- ☐ reserve meeting accommodations
- ☐ set up audio/visual logistics and any remote access needs
- ☐ confirm attendance of participants
- ☐ arrange recording or designated note-taker.

A.2.2 Capture Knowledge

The capture stage of the knowledge transfer should include meeting logistics, guided discussions, media collection, and meeting recording.

A.2.2.1 Guided Discussions

The knowledge transfer meeting should move from one topic to the next. However there may be cases where keeping the order determined by the final agenda is not as advantageous as allowing the knowledge expert the freedom to discuss topics as they come up over the course of conversation. This allows the subject matter experts to introduce new topics during the discussions as necessary in an effort to obtain implicit knowledge (the “what steps did you take?” type questions) and tacit knowledge (the “why do you?” type questions) as well as to keep the dialog flowing. At the same time, it is important to track the topics on the agenda to ensure that each topic is discussed.

Participants should keep in mind that the information being gathered is from the outgoing expert and, thus, the outgoing expert should be allowed to dominate discussions. Reflection and questions for clarification should be encouraged to assure that the outgoing expert is understood and has time to think about the answers to questions being asked, or to elaborate on the topic.

Topics for discussion identified as related to specific current needs, projects, or efforts should be captured in a manner that easily identifies the future purpose. Again, while every effort should be made to complete the agenda, the outgoing expert should not be discouraged from discussing related issues that may arise during the conversations. Some latitude for thoughtful discussion needs to be considered.

A.2.2.2 Media Collection

Documents and presentations may have already been sent by the outgoing expert for preservation; however, any additional new media the outgoing expert brings to the meeting should be collected and duplicated. Some discussion of the sent materials may be necessary for context or agreement of how this information can be stored for future use. Original media should be returned to the outgoing expert, as requested.

A.2.2.3 Meeting Recording

During the capture knowledge stage, a designated note-taker should document meeting recordings and share this information with the participants to ensure completeness. The notes should organize topics and discussions to capture additional information, conclusions, or actions.

A.2.3 Transfer Knowledge

Following the capture knowledge stage, a draft meeting summary report should be developed and sent to the outgoing expert for review and acceptance. Comments from the outgoing expert and other meeting participants should be incorporated into the final meeting summary report and the report should be filed where it can be accessed by participants and other interested staff (e.g., on EARRTH). In addition, specific discussions related to ongoing work (in the case of Dr. Masnik, revisions to Environmental Standard Review Plans [ESRPs] and Regulatory Guide 4.2) should be isolated and passed on to appropriate team leads, relevant staff, and subject matter experts.

In some cases, the type of information received cannot be easily organized into specific tools, but rather is part of a conceptual framework model, general expertise, or background information. This information should still be captured and summarized in the meeting summary report.

A.2.4 Share and Communicate

To reduce the impact of knowledge loss and increase the benefits of knowledge retention, all relevant information that was captured and transferred should be communicated and integrated into documents and tools for the dissemination of information to appropriate staff. A knowledge transfer report similar to the Knowledge Transfer Report for Dr. Michael Masnik should be created.

For increased efficiency, effectiveness, and organizational memory, information should be communicated and shared so that it is readily available and easy for reviewers to locate (NRC 2013). When possible, the outgoing expert should review any information that has been incorporated into documents, programs, or tools, thus allowing for clarifications, corrections, or further elaboration as necessary. Examples of specific documents and tools that should be considered appear in the following sections.

A.2.4.1 Formal NRC Guidance Documents

Guidance documents (e.g., the ESRP and Regulatory Guides) are excellent places to capture explicit knowledge and relevant information to ensure that it is available to future reviewers. This method works well for concrete suggestions and information. Implicit knowledge may also be integrated into formal guidance documents, especially as it relates to the process that future reviewers should use when developing agency products such as environmental impact statements.

A.2.4.2 Qualifications Program

Information related to how subject matter experts are identified and mentored is useful for updating reviewer qualifications programs and ensuring that new reviewers have the benefit of relevant information to be able to conduct reviews. A qualifications program is a good location to capture both explicit and implicit knowledge. For example, Dr. Masnik provided his presentations from workshops designed to provide additional information for new reviewers on NRC licensing and review processes.

A.2.4.3 Tools

EARRTH tools (e.g., guidance for reviewers and team leads, lessons learned and resource-specific areas) are ideal for storing useful information that is not formal enough to be included in published guidance documents. All three types of knowledge: explicit, implicit, and tacit can be incorporated into tools for the benefit of knowledge retention. For instance, Dr. Masnik provided information related to tactfully and respectfully responding to public comments. He also provided documents he prepared as lessons learned from contested hearings that are now included under a “lessons-learned” subject area on EARRTH, and cross-referenced to the “hearings” subject area and the Roadmap for Review and Team Lead Guidance.

A.3 Summary

The knowledge transfer process is important for minimizing the impact of knowledge loss and retaining historic knowledge and ensuring this knowledge is shared with current and future reviewers. The process increases communication and collaboration within the agency and project teams, improves productivity and efficiency, and positively impacts overall performance (NRC 2013), The knowledge transfer process documented above was developed in support of NRC's Knowledge Management Program and aligned to reflect the applicable steps that are described in NRR Office Instruction No. ADM-506, Knowledge Management Process (NRC 2007a). This process should be revisited and improved upon as lessons in knowledge transfer are learned over time, to help ensure all relevant information and ideas are captured.

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Appendix B

Agenda and Attendance at Each Session
Knowledge Transfer – Dr. Michael Masnik – August 19-21, 2014

Each of us takes the information and lessons we learn from previous NEPA reviews and uses that as a basis for determining how we approach subsequent reviews. Mike has the longest historical experience on aquatic NEPA reviews for the U. S. Nuclear Regulatory Commission of any current NRC staff member. We would like to use the information that he has obtained over the years as the basis for continued revisions in documents (such as the ESRP or Regulatory Guide 4.2), a lessons-learned document and possibly an orientation document for new aquatic ecology reviewers.

This can be seen as an extension of information we obtained in the development of the original orientation (2008) series, the RWET orientation.

Tuesday, August 19th –ISB 2 – Viz Lab, Room 105

9:30–10:00am	Discuss 3 day plan with Mike; discuss potential questions (as provided in part in advance to Mike) – (Mike Masnik/Becky Krieg/Ann Miracle/Jeff Ward/Joanne Duncan)
10:00–12:00am	Aquatic reviews (Mike Masnik/Becky Krieg/Ann Miracle/Jeff Ward)
12:00–1:00pm	Break for lunch
1:00–4:00pm	Aquatic reviews continued (Mike Masnik/Becky Krieg/Ann Miracle/Jeff Ward)

Wednesday, August 20th – ISB-2 - Cold Creek, Room 402

8:30–10:00am	General Terrestrial discussion (Mike Masnik/Becky Krieg/Amanda Stegen/Ann Miracle/ Corey Duberstein/Jeff Ward)
10:00–11:30am	Terrestrial and aquatic consultations (Mike Masnik/Becky Krieg/ Amanda Stegen/Ann Miracle/ Corey Duberstein/Jeff Ward)
11:30–12:30pm	Break for Lunch
12:30–2:00pm	Terrestrial/hydrology and aquatic (Mike Masnik/Becky Krieg/Amanda Stegen/Ann Miracle/Corey Duberstein/Jeff Ward/Nancy Kohn/Lance Vail)
2:00–3:30pm	Discuss tools to capture data (Mike Masnik/Becky Krieg/Ann Miracle/Nancy Kohn/Chris Ross/Joanne Duncan)

Thursday, August 21st - ISB-2 - Priest Rapids, Room 214

8:30–12:00pm	Three Mile Island (Mike Masnik/Becky Krieg)
1:00–4:00pm	Wrap up questions and tools (Mike Masnik/Becky Krieg/Ann Miracle/Chris Ross)

Appendix C

List of Potential Knowledge Transfer Topics (distributed prior to the meetings)

General topics for discussion with sample questions to kick-start thinking:

1. NRC and the NEPA Process - General
   - What are the top concerns/issues you have seen related to how NRC complies with the NEPA process
2. The EIS Process
   - What do you think the Agency and your team does really well and what do you think could be done better related to NEPA reviews?
3. Aquatic/Terrestrial/Hydrology Interfaces With the Environment
   - How do you weigh the impact on a species/habitat/resource within the affected environment in relationship to a geographic area of interest?
4. Consultations and USACE
   - What are your thoughts on what works best/what does not work when communicating and determining effect levels with FWS, NMFS, and USACE?
   - Where do we do a good job and where could we improve in balancing the requirements of NEPA and the Section 7 requirements.
5. Mitigation
   - What is the NRC's role in proposing or reviewing mitigation plans?
6. Guidance (ESRPs, Regulatory Guides)
   - What degree of detail should be included in the ESRPs (should we provide lessons learned)?
   - How often should guidance be updated, or should recent revisions be generic enough to stand through time?
7. Consistency
   - How much consistency is needed between past and future EISs (including license renewal)?
8. Small Modular Reactors
   - What do you see as the future for new reactors; how will small modular reactors change our review process?

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