September 2013 IEG Meeting Summary Report

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Principal Contributors

Robert Coward
Anton Leshchenko
Joel. Pijselman
Adrian Simper
Nikolai. Steinberg

Prepared for

International Research Institute for Nuclear Decommissioning (IRID)

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1 Introduction

1.1 MEETING INFORMATION

Dates:	September 23-27, 2013
Location:	Tokyo (Monday and Friday) Fukushima Daini (Tuesday-Thursday) Fukushima Diaichi (Wednesday)
Members of IEG Present:	***Principal Personnel Contacted:***
Robert Coward (for D. Chapin) Anton Leshchenko Joel. Pijselman Adrian Simper Nikolai. Steinberg	Listed in Appendix A
Agenda	Included as Appendix B

1.2 IEG MISSION

The IEG is part of the organization developed by IRID to provide support and advice to IRID and TEPCO to contribute to the successful decommissioning of Fukushima Daiichi. As defined by IRID and TEPCO:

> *The mission of the International Expert Group (the "IEG") is to contribute to the safe and efficient implementation of the decommissioning of the Fukushima Daiichi Nuclear Power Station (the "Decommissioning") and R&D activity for the Decommissioning, by providing advice to The International Research Institute for Nuclear Decommissioning (the "IRID").*
>
> *The IEG shall provide such advice to IRID from an objective perspective based on the collective view of the IEG reflecting the differing international expertise and experience of each member of the IEG.*

The IEG provides IRID with recommendations on the specific issues faced at Fukushima Daiichi and the specific issues of Research & Development for decommissioning.

2 Conclusions and Recommendations

2.1 CONCLUSIONS

TEPCO has made progress at Fukushima Daiichi. Evidence of this progress is easily seen when visiting the site. The TEPCO and contractor teams are dedicated and hard working.

There are ongoing and future technical challenges to execute the Fukushima decommissioning. However, right now the organizational and stakeholder challenges associated with the ongoing work are more significant and more important. IEG believes it will be difficult to make the overall progress desired by all stakeholders without progress on these softer issues.

IRID was formed recently to provide a separate organization to focus on the medium and long term research and development needs for decommissioning in Japan (Fukushima Daiichi and other sites). This organization change, which separated that function from TEPCO and involves other utilities and the Japanese NSSS vendors, coupled with increased involvement and support from METI provide a potential foundation for improved effectiveness of the combined organizations. The key will be for the Leadership of all organizations to commit to the success of the program.

The key challenges to be addressed are:

- Stakeholder engagement and education – Challenges arising from societal considerations are slowing progress at the site, creating additional work, and generally making the project harder. TEPCO, IRID, and METI can all improve engagement with stakeholders and contribute to improved education of those stakeholders on critical topics.
- Prioritization of activities – There is a significant amount of work needed and planned at the Fukushima Diaichi site and at the Tokyo offices to support that work. Trying to accomplish too much at one time will prevent progress and create additional challenges. As a result, the work should be prioritized, and that prioritization should be agreed by all participants. It is better to do fewer things well, than to try many things and not do them well.
- Definition of Interim and End States – In order to confirm they are working in the right direction and to guide their activities, TEPCO and the contractor teams need to be aware of key interim and end states. These need to be developed. Further, developing the interim and end states will likely identify additional policy and strategy questions to address and resolve (enhancing the plan).
- Organizational alignment and effectiveness – It is imperative for success at Fukushima Daiichi that all participating organizations operate smoothly, both as stand-alone companies as well as collaborative partners in an overall project organization. The effectiveness of the organization must be high and all organizations must be aligned on project direction forward, prioritization of activities, and key outstanding questions and risks.

The IEG sees opportunity and need for improvement in each area listed above.

A parallel issue is public confidence. Developing and maintaining public confidence is vital – the project will not succeed without it, and the best way to improve confidence is to improve organizational effectiveness. There are two specific ways to increase public confidence in TEPCO and the overall project. First, it is critical to meet all commitments. Performance meeting commitments can be enhanced through three checks: (1) when commitments are made, they must be within the capability of delivering organization, (2) top down goals must be validated by bottom up planning, and (3) the amount of work involved must be reasonable. Second, it is important for TEPCO, IRID, and METI to understand fully that they are partners in this program and they need to act as partners in all aspects, including mutual public support.

There are many questions regarding how Fukushima Daiichi will be decommissioned, and there are people working to address these questions. It is important to recognize that there is a hierarchy to defining priorities and work:

Policy defined → supporting strategies developed → implementation plans finalized

It is difficult for a single organization to fill all three of those roles. As the Division of Responsibility between TEPCO, IRID, and METI is finalized and adjusted, each of these roles should be considered separately.

It is important for all stakeholders to recognize and accept that Fukushima Daiichi is no longer a nuclear power plant site. It is now a decommissioning site. As a decommissioning site with significant amounts of unknown conditions on site, there will be regular and routine surprises and emergent issues that were unanticipated. The way all stakeholders look at Fukushima Daiichi needs to reflect this situation. This includes government and the NRA. Policy development and regulation need to respond to realities of the situation.

TEPCO is presently pursuing at least eight major work programs at Fukushima Daiichi. These include:

1. Remediation of the trenches
2. Restoring the subdrains to operability
3. Implementing groundwater bypass
4. Improving risk management of the contaminated water storage tanks
5. Increasing ALPS capacity and improving its reliability
6. Considering reductions in cooling water flow to the Reactor Buildings and potential installation of local water treatment system capability
7. Preparing for and implementing Unit 4 spent fuel removal
8. Preparing for Unit 3 spent fuel removal

In parallel with the work at the Fukushima Daiichi site and supporting that work, there are also important activities underway in the strategy and policy area, including:

1. Development of national waste policy to allow defining interim and end states for Fukushima Daiichi

2. NRA developing a regulatory environment suitable for the realities of decommissioning (instead of an operating nuclear power plant)
3. All organizations' role in stakeholder engagement and building public confidence

These are long lists of important and hard objectives. It is important to continually prioritize the work activities, achieve stakeholder alignment around the prioritization, and apply the proper focus on the high priority activities. The IEG notes that this may require difficult choices as work is prioritized. However, prioritization is crucial to achieve success.

2.2 RECOMMENDATIONS

The primary IEG recommendations from this meeting are:

1. Review the priorities for Contaminated Water countermeasures and adjust work plan accordingly to ensure effort is focused on high priority actions with the best impact toward the project objectives. This will involve aligning actions with goals and priorities and taking actions to reduce the risk of unexpected events and the consequences of those events.

2. Improve expectation management with the public. It is critical to improve engagement with all stakeholders to improve their understanding of the risks at Fukushima Daiichi, both current and future risks. Also, ensure internal work schedules have margin compared to external schedules so that all external schedule milestones are satisfied.. The public needs to have expectations for TEPCO and the work at Fukushima Daiichi that are realistic and informed.

3. Improve clarity of organizational roles and responsibilities among TEPCO, METI, IRID and other key organizations. This includes ensuring the Division of Responsibilities of all parties is communicated and understood by all stakeholders and participants, not just the senior leaders. Also, ensure project priorities are shared, understood, and communicated among all stakeholders.

4. Make meaningful progress on the critical need define Interim and End States. This information is needed to provide direction for ongoing activities, to improve their effectiveness, reduce future rework, and lower overall risk. The IEG notes this will likely require addressing national policy questions related to nuclear waste (high level and low level). Until the End States and key milestones are defined it will be difficult to develop and implement a clear plan – this needs to be a high priority action.

5. Perform a rigorous readiness review of plans and bases for performing Unit 4 spent fuel removal. This review should focus on potential upset or unexpected conditions, the safety significance, and how they will be addressed. The review should also include participation by personnel from outside organizations to gain the insights from their independent thinking (this includes the IEG).

Additional IEG suggestions to support the meeting discussion topics are provided in each subsection of Section 3.

Finally, the IEG highly recommends that IRID and the IEG implement an approach that maintains the IEG engaged with IRID and TEPCO personnel on a periodic basis between IEG meetings. The IEG will provide IRID separately with a suggested approach to achieve this objective.

2.3 NEXT IEG MEETING TOPICS

Based on the results of this meeting, upcoming activities and needs, and discussions with TEPCO, IRID, and METI personnel, the IEG anticipates engaging on the following topics at the next meeting (tentatively scheduled for February 2014):

- Roadmap, in particular Interim and End States that may be included in next revision (expected in Spring/Summer 2014)
- Progress in the development of IRID and its effectiveness as an organization working with the other organizations
- Design processes for development of medium and long term systems and equipment to be installed and/or used at Fukushima Daiichi
- Planning for fault and off-normal scenarios during upcoming activities
- Fuel debris removal, including evaluation of feedback from the international solicitation
- Site clean-up and restoration to upgrade work conditions
- Most effective methods for engaging IEG members to contribute outside of team-wide meetings

In addition to planning for these topics at the next meeting, the IEG will provide separately potential topics to engage with IRID and TEPCO prior to the next meeting (in order to both stay engaged between meetings and to contribute further).

3 Discussion Topics

3.1 FORMATION OF IRID

IRID Leadership provided the IEG a summary of the formation of IRID, including the vision for IRID's contributions and role, and how TEPCO, IRID and the various government agencies (in particular METI) will collaborate on the decommissioning of Fukushima Daiichi. Of particular note are two objectives for IRID:

- IRID is intended to be a window to the international community to identify experience and technology that may benefit decommissioning activities in Japan.
- IRID is intended to pursue research and development that will benefit decommissioning of all nuclear facilities in Japan (not just Fukushima Daiichi).

IEG observations include:

- The goals and vision for IRID are good. Separating those functions from TEPCO and allowing a single organization to focus on the medium and long term development needs should improve the effectiveness of those activities.

- There is a need for clarity in organizational roles, responsibility, and accountability between TEPCO, IRID, and METI. The vision for how these organizations will collaborate is a change from the way of working for the past two years. Given this change, it is critical that the role and responsibilities of each organization be defined and communicated clearly and broadly. This includes ensuring the roles are understood by all project participants, not just the executives.

- Achieving the new way of working between TEPCO, IRID and METI will require a significant investment of time and focus by the leadership of those organizations. It will be important to maintain a commitment to improve communication and alignment and shift the overall project toward the organizational vision.

Specific IEG suggestions concerning the formation of IRID are provided below. These are intended to provide advice on how to develop and ensure clear division of responsibility between TEPCO, IRID, and METI.

1. Schedule and perform self assessments of the progress of IRID developing as an organization and achieving the desired vision, role, and collaborative relationship with TEPCO as well as contributions to progress of the 1F decommissioning.

2. Develop an internal website (inside IRID and TEPCO) for the purpose of communicating critical information to the IRID and TEPCO project teams. The website would address topics such as:
   - Division of responsibility between IRID, TEPCO, and METI
   - Current priorities for the overall project
   - Current priorities for each organization
   - Implications for health and safety of the workers and the public from the current conditions. These would be key talking points all stakeholders should understand and communicate.

   The existence of the website should be communicated broadly among all project participants and personnel should be encouraged to visit the site regularly.

3.2 FUEL DEBRIS REMOVAL R&D SOLICITATION

IRID provided the IEG a summary of the planned international solicitation to identify research topics to investigate and develop options for fuel debris removal from Fukushima Daiichi Units 1, 2 and 3. The objective of the solicitation is to engage international organizations and companies in an effort to stimulate creation of innovative ideas for removal of fuel debris in the challenging conditions at Fukushima Daiichi. Of important note, IRID and TEPCO have a vision to provide international equal opportunity (with the Japanese vendors) to contribute to and participate in the work at Fukushima Daiichi.

IEG observations include:

- The objectives to engage with international organizations and to engage with them early in the process are good. This is a solid approach for identifying world-wide innovative ideas for overcoming the technical challenges at Fukushima Daiichi.

- The current plan for fuel debris removal is to seal the primary containment vessel (PCV) of each unit, flood the reactor and containment vessels, and perform the debris removal underwater. This approach has advantages, but also has risks, especially since TEPCO does not know yet if the PCVs can be sealed. Thus, the plan to consider other options beyond a flooded PCV is a good contingency approach.

- The planned approach for performing the solicitation, including how the solicitation is presented to potential responders could create a risk that the number of responses will be low and that the target organizations with the best experience and capabilities may not respond. This is driven by four factors:
  - Concerns about ownership of Intellectual Property: the current plan is for the Japanese Government to own any Intellectual Property developed in the research (not the originator of the ideas).
  - Concerns about whether this solicitation will create a real opportunity for the market: many of the target organizations have primary missions to sell solutions and services, not to sell ideas. These organizations will desire to have a line of sight to meaningful roles supporting the development and implementation of their ideas. Although the long term

vision of IRID and TEPCO is for those organizations to have that opportunity, right now they cannot make that commitment.
- Concerns about Japan's history as a closed market: historically, services and solutions provided to Japanese nuclear power plants have been overwhelmingly provided by Japanese vendors. This has resulted in many organizations around the world viewing Japan as a closed market with little opportunity for them. The long term of IRID and TEPCO is to have an open market supporting Fukushima Daiichi, but work likely remains to convince the market place of this commitment.
- Concerns about the time scale for the process: IRID anticipates executing this solicitation process on an aggressive schedule. This may cause some organizations to conclude they cannot support the schedule needs for the process.

Specific IEG suggestions concerning the planned solicitation are provided below. These suggestions focus on approaches for communication with potential responders to ensure they understand the IRID/TEPCO long term vision for international participation and will actively engage with IRID.

1. Engage with IEG members and international advisors to identify the key organizations most likely to provide technology and innovative ideas that could contribute to the overall program goals, as well as organizations in leadership roles that would influence other organizations view toward the solicitation. Reach out to those organizations and schedule one-on-one meetings to:
   - Ensure those organizations fully understand the IRID vision for technology development and implementation of solutions
   - Encourage them to participate as well as to encourage other organizations to participate
   - Listen to their concerns about the solicitation and the planned process

   After the meetings, consider revising or updating the solicitation based on the feedback.

2. In all meetings with potential responders, both small group meetings as well as larger public meetings, reinforce the long term goals for international participation in the overall program, including the vision for non-Japanese companies to participate in on-site implementation of solutions.

3. Through the solicitation process, IRID and TEPCO should develop a program for assessing of opportunity to convert fuel debris cooling from water cooling to air cooling (there would be important advantages). This program should include the option to exclude the turbine building from the cooling process as the first and very important step.

3.3 CONTAMINATED GROUNDWATER

The management of contaminated groundwater at the Fukushima Daiichi site and the implications of potential contamination releases was a main discussion topic of the IEG meeting. The TEPCO team provided summaries of the current status on site, including recent measurements of contamination and dose, as well as the status of ongoing and planned countermeasures to improve the situation.

IEG observations include:

- IEG does not see an immediate threat to people or environment from the conditions on site. Yes, there is contamination in the groundwater near the buildings and some of that contamination is reaching the port. However, the levels of contamination are well below any applicable regulatory limits everywhere (including nearby offsite in the ocean) except for one location in the port near a contaminated trench. Even at this location, the contamination levels are comparable to the regulatory limit for releases. It is important to improve the situation, including reducing the amount of contamination reaching the port and the amount of contaminated water being generated, but there is not an emergency on-site, and emergency actions are not required.

  The public does not understand the results and meaning of radiation measurements published by TEPCO, especially with regard to beta dose rate measurements. Confusion about measured equivalent dose rates and effective dose rate in the TEPCO handouts leads to unwarranted public anxiety. The IEG notes that this apparent conflict – the public perception of a safety significant emergency on-site when the actual condition is acceptable and within regulatory limits, highlights the need for improved communication and stakeholder engagement and education. These are needed to improve public confidence as well as reduce the number and extent of distractions to the ongoing work program.

- Based on the data and information provided, the IEG sees three primary objectives of improving the management of contaminated groundwater. These three objectives are related, but each is also important as a stand-alone objective.
  - Reduce the risk of contamination entering to ocean (at the port). This is both good practice (stewardship of the environment) and important to building public confidence.
  - Lower the water levels in Reactor and Turbine Buildings. This is needed to enable access to the building to characterize their condition as well as begin characterizing the condition of the PCVs.
  - Reduce amount of water requiring treatment and storage. The existing site systems are generating about 400 tons/day of contaminated water, requiring considerable treatment capability and large storage capacities. It is impractical to continue in this mode for the long term.

- Achieving these objectives requires prioritizing the on-site countermeasures and actions, placing the greatest priority on the actions expected to provide the greatest benefits toward the objectives. Based on the available information, the IEG suggests the following priorities:
  1. <u>Trench remediation</u> – The most significant source of contamination reaching the ocean appears to be from the contaminated trenches between the Turbine Buildings and the port. Remediation of the trenches (removal of contaminated material and sealing the trenches) will greatly reduce the amount of contamination reaching the ocean.
  2. <u>Restore subdrain functionality</u> – The Reactor and Turbine Building subdrains have not functioned since the tsunami. These systems were originally designed and installed for the purpose of managing groundwater around the buildings. Restoring this capability will reduce the amount of groundwater flowing into the buildings, reduce the amount of

contaminated water being generated, and will enable reducing the water level in the buildings.

3. Groundwater bypass – TEPCO is planning to implement groundwater bypass. In this approach, wells will be installed and groundwater removed upstream of the buildings and the clean water diverted to the ocean. This will reduce the amount of groundwater near the buildings, reduce the demand on the subdrains, and reduce the amount of water flowing past the buildings into the ocean.
4. Consider options for reduction of cooling water flow – Currently the cooling water systems pump a total of about 400 tons/day of water into the Reactor Buildings for fuel and fuel debris cooling, causing the water to become contaminated in the process. This water then requires treatment and storage. TEPCO should evaluate the potential to reduce this cooling water flow to reduce the amount of contaminated water being generated. Options up to and including air cooling may be practical depending on the conditions in each unit.

In addition to these prioritization recommendations, the IEG suggests the following specific actions be considered:

1. Define priorities and adjust the work plan accordingly. It is important to recognize that TEPCO cannot do everything at the same time and that prioritizing the goals and work plan is necessary.

2. Update and improve TEPCO and METI communication materials to more accurately reflect site conditions and the actual consequences of contaminated ground water.

3. Develop and implement an overall engagement campaign with stakeholders to help them understand the actual conditions and the actual consequences of the site conditions. It is critical to influence public opinion and get society to understand the actual consequences at the site.

4. Change the public presentation of dose rates to properly describe the actual dose rates and actual consequences at the site. Consider additional public outreach to communicate regarding impact of dose rates on human health, as well as including comparisons of dose received at the site compared to annual limits and natural radiation sources.

Ice Dam

METI and TEPCO are planning to create an ice dam around the Units 1 to 4 Reactor and Turbine Buildings. In this approach the ground is frozen to a depth below the active water table and used as a seal to prevent groundwater flow into the building area (to minimize groundwater flow into the buildings). The IEG discussed the ice dam plan and provided the following summary comments:

- The objective of the ice dam is clear (to prevent clean groundwater from entering the buildings and becoming contaminated). Given the uncertainties on site it is worth pursuing as a feasibility study basis as a potential contingency.

- The ice dam will be a first-of-a-kind application of technology in Japan and is currently unproven in the geology and soil conditions at the Fukushima Daiichi site. Further, the ice dam will result in significant change to the natural groundwater flow on site. Although the IEG members are not experts in hydrology and groundwater flow, their collective experience is that changes of this magnitude can have unintended and unexpected consequences (accurately modeling these conditions and phenomena is hard). As a result, it is very important to evaluate in detail the feasibility and impact of the ice dam before making a firm commitment to implement it. In particular:
  - Studies are needed to investigate and understand the likely impact on groundwater flow, building stability, and soil conditions. The local soil within the ice dam supports the existing buildings and will be the foundation for future structures constructed to support decommissioning. Understanding any potential impacts due to the changes in groundwater flow and soil properties is critical. For example, does the seismic capability of the structures change after implementing the ice dam?
  - Physical trials and testing are essential to confirm the feasibility of implementing the ice dam as well as to determine its effectiveness.

- The final decision to implement the ice dam and the appropriate schedule should be decided based on the results of the feasibility studies (including testing and impact on site structures) as well as the site conditions after restoring the subdrains and implementing groundwater bypass. There is a reasonable possibility the ice dam may not be necessary if the subdrains are functioning properly and groundwater bypass is diverting much of the groundwater away from the buildings.

Shield Wall

TEPCO is installing a shield wall in the port to prevent contaminated groundwater flow into the ocean from leaving the port and spreading to the neighboring environment. The wall is about 50% complete with plans to finish in 2014. The IEG discussed the shield wall plan and provided the following summary comments:

- The objective of the shield wall is clear (to prevent contaminated groundwater from leaving the immediate port area). Given the uncertainties on site it is worth pursuing as part of a defense-in-depth strategy.

- It is important to complete additional evaluations of the shield wall before completing the final section and sealing the port from the ocean. These evaluations need to address the potential for unexpected consequences and how to be prepared for potential undesired developments. These include:
  - The potential for unintended consequences on site groundwater flow. There is about 800 tons/day of groundwater coming down the hill flowing toward the ocean. Currently, about 400 tons/day leaks into the Reactor and Turbine Buildings and about 400 tons/day flows into the ocean. When the shield wall is complete, the same amount of water will still want to flow down to the ocean, and with the shield wall in place the overall nature of the groundwater flow will change. The potential for unintended consequences (for example, greatly raising the groundwater level in the ground adjacent to the ocean and as a result changing the soil properties – or conversely requiring a new pump to continually

pump groundwater out of that area to maintain lower ground water levels) is very real. These changes need to be understood. The IEG briefly reviewed some high level groundwater flow modeling results and was not convinced the model used the proper boundary conditions at the shield wall. Additional reviews and evaluations should be performed.

- The potential for concentrating contamination in one location. If groundwater flowing to the ocean remains contaminated, there could be a concentrating effect of transferring much of the ground contamination to the shield wall area, resulting in increasing dose levels in that area.
- How to handle and manage a potentially large volume of contaminated soil and water. The ground in the area of the shield wall is already believed to be among the most contaminated on site, especially near the trenches from the Turbine Buildings. The shield wall will trap in place a large volume of contaminated and high saline water, likely with additional contamination flowing into the area each day. Special purpose cleanup and handling systems will be needed for the large amount of contaminated soil and water in that area.

The overall IEG comment on the shield wall is that the TEPCO goal should be to prevent contamination from reaching the ocean (i.e., ensure the groundwater reaching the ocean is well below any contamination limits), not to prevent contaminated water from leaving the port.

3.4 TANK LEAKAGE

Along with the overall topic of management of contaminated water at the Fukushima Daiichi site, the recent experiences with leakage from contaminated water storage tanks and how to implement countermeasures to address these vulnerabilities were also main topics for discussion. The TEPCO team provided summaries of the current status on site, including recent measurements of contamination and dose, as well as the status of ongoing and planned countermeasures to improve the situation. It is important to note that, although they are related (both involve water contamination), the IEG sees groundwater management and the issues with tank reliability to be separate issues.

IEG observations include:

- The current situation for storage of contaminated water is not ideal. Numerous bolted tanks with flanged joints creates a high likelihood of leakage. There is minimal margin in terms of capacity and available contingency actions in the event of leaks.
- Actions to improve the situation are needed. The objective of these actions is to remove the risk of contamination from the contents of the tanks.
- Achieving this objective requires prioritizing the on-site countermeasures and actions. Based on the available information, the IEG suggests the following priorities:
  1. Ensure adequate storage capacity – The fuel cooling operations are producing about 400 tons/day of contaminated water, filling about three 1000 ton tanks each week. It is critical to ensure adequate storage capacity while measures to reduce the generation of contaminated water are implemented.
  2. Continue implementation of increased monitoring and surveillance measures – TEPCO is implementing increased surveillance walkdowns and monitoring programs to minimize

the significance of future leaks by identifying them early. These measures should be continued as a high priority.

3. Accelerate additional ALPS capacity – TEPCO is planning to add additional ALPS water treatment capacity to enable treating of the contaminated water stored in the on-site tanks. The design, procurement, licensing, and construction of this capacity should be accelerated.
4. Mitigate risks of leaks – Many of the existing storage tanks are vertical, bolted type tanks that are subject to leakage. Actions should be taken to mitigate risks of these leaks. TEPCO should pursue installing spare tanks to provide margin in the event of leaks (for example, one spare tank for each collection of connected tanks), replacing the bolted tanks and replacing the horizontal tanks. An engineering evaluation considering risks, costs, and schedule, should be performed to differentiate the relative priority between those three actions (spare tanks, replace bolted tanks, replace horizontal tanks).
5. Local treatment capability – Presently, the cooling water systems and ALPS treatment system require pumping contaminated water several km across the site, introducing risks of pipe and fitting leaks in locations away from tanks and buildings. TEPCO should consider designing and installing local water treatment capability in the Turbine Building (or adjacent to the building) for each unit, allowing treated water to be pumped to storage tanks instead of contaminated water.

Specific IEG suggestions concerning potential tank leakage are provided below.

1. Consider redundant control of tank water level and include functional tests of level sensors. Also, countermeasures against accidental overflow of tanks should be implemented. As stated in IAEA safety guide: "There should be reserve storage capacity available to accommodate waste arising in various situations. Such situations may include abnormal conditions (e.g. the need to empty a leaking tank) or periods when modifications or refurbishments are being undertaken" (paragraph 6.58. Storage of radioactive waste: safety guide. — Vienna: International, Atomic Energy Agency, 2006).

2. As a countermeasure against contaminated water leakage, an empty tank should be installed in the tank storage area. The tank storage area should have adequate illumination to support inspections of the tanks and emergency response operations in the dark.

Finally, the IEG also notes that:

- Replacing the bolted and horizontal tanks with more reliable tanks does not reduce risk of piping leaks. These can only be mitigated through local water treatment near or in the buildings so that the piping contains treated water rather than contaminated water.
- Discharge of treated water to the ocean would create immediate storage capacity. Pending a more detailed evaluation of surveillance data, the IEG sees no safety or environmental reasons preventing discharge of treated water from the storage tanks to the ocean. Of course, TEPCO must maintain any discharge within its existing regulatory limits.

3.5 ROADMAP

TEPCO provided the IEG a summary of the latest revision of the Fukushima Daiichi Decommissioning Roadmap, with a focus on explaining the changes in the June 27, 2013 revision.

IEG observations include:

- Building public confidence in TEPCO and the ongoing work at Fukushima Daiichi is critical. Without that confidence progress will continually be slowed by distractions and emergent issues driven by societal and political reasons, not technical or scientific. The Roadmap is an important tool to contribute to building that confidence (in addition to providing an overall direction and guide for the work program).

- The Roadmap should be relative stable, defining key policy items and the important Interim and End States. The most recent revision has added some detailed and more tactical items. The Roadmap should remain at the strategic and policy level of information.

- The Roadmap dates should be realistic and achievable. In the June revision the start dates for removal of spent fuel from Units 1 and 2 were moved up by about 18 months. This was at a time without major advancement in knowledge of site conditions, in particular the ability to access the fuel and ability to remove it. This revision appears unnecessary and likely aggressive.

Specific IEG suggestions concerning the Roadmap are provided below. These suggestions focus actions to increase stakeholder confidence in the Roadmap and improve its use as a guidance document.

1. In the next revision of the Roadmap:
   - Revise the spent fuel removal dates to be less aggressive
   - Include notes to recognize the important uncertainties and the potential impact on schedule (do not over promise)
   - Remove the detailed tactical information (for example tank leakage); keep the Roadmap focused on longer term strategic goals and plans
   - Include additional information on important interim and end state conditions

2. Begin developing this next revision immediately and use that process to identify the critical information needed to complete the revision (for example the interim and end states). This will allow that information to be developed in parallel.

3. Using the Roadmap as a tool and guide, it is import to improve world-wide communication. TEPCO and IRID should consider reaching out to society in the Fukushima area, in particular, doctors, teachers, etc., and training/informing them about radiation and its effect on the environment and people's health – enable them to assist TEPCO as messengers to society. Also, it is important to present to society clear explanations of the activities of the Government, TEPCO, IRID, and others to overcome the consequences of the accident. The first step is to communicate among potential messengers with single voice in a coherent and

consistent approach. It is very important – people should understand the worlds they hear or read, and every word is written must be understandable. This initiative may potentially be led by IRID or the government because of the current negative perceptions of TEPCO.

4. As part of the Roadmap communication, consider informing the public about the risk of potential incidents during the decommissioning process (manage expectations). The public needs to understand that the decommissioning process involves risks of contamination of the environment. Risk analyses of future operations should also include potential human errors.

3.6 SPENT FUEL REMOVAL

TEPCO provided the IEG a summary of the latest plans for removal of spent fuel from Unit 4 along with some summary updated information on the longer term Unit 3 plan.

IEG observations include:

- TEPCO has made good progress preparing Unit 4 for spent fuel removal. The fuel removal structure is impressive and was designed and constructed successfully on a rapid schedule.

- TEPCO plans to begin removing fuel in November and for the fuel removal operation to require about 12 months (there are about 1550 assemblies in the pool). Based on this schedule and the discussions with TEPCO personnel, the IEG believes the overall plan may be too optimistic. The rate at which assemblies will be removed from the pool and placed in transportation casks appears to assume an efficiency closer to an operating power plant than the damaged decommissioning facility present at Fukushima Daiichi. It is inevitable that there will be surprise issues and challenges during fuel removal, whether it be damaged fuel, damaged racks or some unexpected fuel assembly/fuel rack/debris interaction.

- The Common Spent Fuel Pool has space for about 1/3 of the assemblies in the Unit 4 spent fuel pool. Moving assemblies to the Common Spent Fuel Pool will require a coordinated effort to also in parallel move assemblies from the Common Spent Fuel Pool to dry cask storage. There is space in the Common Spent Fuel Pool to allow beginning removal of the Unit 4 assemblies; however, there are not storage casks on-site to begin moving fuel assemblies out of the Common Spent Fuel Pool.

Specific IEG suggestions concerning spent fuel removal are provided below. These suggestions focus on increasing the robustness and confidence of the overall plan for spent fuel removal.

1. Perform a rigorous Readiness Review of the plan to remove spent fuel from Unit 4. This review should include independent personnel as well as IEG members. The review should focus on potential difficulties and upset/fault conditions along with implications of, and contingency plans for each one. Do not begin fuel movement activities until the review is complete and follow-up actions complete as well.

2. Perform a review of the Unit 3 spent fuel removal activities, including status, risks, plans, etc., and confirm the work plan is appropriate in the overall site priorities.

3.7 SITE VISIT

The IEG made a visit to the Fukushima Daiichi site on the afternoon of September 25. The tour led by TEPCO included inspection and observation of:

- Contaminated water storage tanks, including the tank with recent leaks
- Unit 4 spent fuel removal structure, including the refueling floor
- Shield wall under construction in the port

The tour also included observation of general progress on the site, progress removing rubble from the Unit 3 Reactor Building, the dry storage cask facility, and the dike system from the transportation bus.

IEG observations include:

- Progress can be seen at the site. The most obvious examples are the Unit 4 spent fuel removal structures and equipment, removal of rubble from the Unit 3 Reactor Building, and improved site access. The TEPCO team is dedicated, working hard, and making progress.

- The IEG considers that radiation protection practices on the Fukushima Daiichi site seem overly conservative for the site conditions. For example, all workers on-site were full face masks, even though the airborne contamination levels are well below applicable criteria necessitating respirators. Although this may appear to be a conservative decision, the IEG is concerned that from a holistic view of worker risk, this may actually be a non-conservative decision that increases worker risk and has a negative impact. In particular:
  - Full personnel protective equipment (PPE), including masks/respirators increases the risks of industrial accidents and injuries. TEPCO noted multiple instances in the past year of workers fracturing limbs because of reduced visibility with masks. The increase in industrial risk may exceed the minimal reduction in radiological risk.
  - Full PPE decreases worker productivity, requiring workers to spend even longer periods in the site environment, increasing their overall risk profile.
  - Finally, unnecessary PPE can send unintended messages to the broad community. This has two potential impacts. First, the morale of the work force is reduced, impacting performance and increasing risk. Second, it contributes to the difficulties achieving public confidence in the ongoing work at the Fukushima Daiichi site.

- The site appears to still be operating in "crisis" or "emergency" mode rather than a more normal mode of operations. TEPCO acknowledged this condition, saying they were making progress prior to the recent tank leaks that pushed them back into emergency mode. Further, there always seemed to be some emergent issue that prevented making the shift to normal mode a reality. The IEG noted that there will continue to be emergent issues, challenges, and surprises for year as the full condition of the site is learned and new activities are initiated. Sometimes you simply need to make the shift now, even if will be hard.

Specific IEG suggestions concerning the site conditions are provided below. These suggestions focus on practices to improve worker efficiency as well as reduce overall worker risk (radiological and industrial) and worker burden.

1. Develop a coherent and consistent program for the site clean-up and enhancement of the radiation protection regime. The program should be developed for two to three years with specification for each year (quarter). The program should include tasks for the cleaning of the 1F territory and premises, as well as inside units 1 through 4. The program should also cover the site with asphalt and concrete and restore landscaping where it is possible and acceptable, zoning of the territory and premises according to level of contamination and dose rates. Development and implementation of such program is necessary to change the psychological condition of the staff and regain respect of society.

2. Reduce overall safety risks, including industrial safety risks. Begin a transition to having small area radiation/contamination work areas near the storage tanks, near and in the reactor and turbine buildings, and near other high contamination areas on site. The required protective equipment and clothing should be based on the conditions in the planned work areas. For example, eliminate the need for full face masks in areas with low airborne contamination levels.

3. Develop and implement a Communication Campaign for the site workers to help them develop a better understanding of the consequences of the actual site conditions and the impact on health and safety.

3.8 IEG OPERATIONS

The IEG reviewed its own performance during the meeting to identify potential adjustments to improve effectiveness of future meetings. The IEG review identified that:

- The IEG is coming together as a team. The members have complementary skills and experience and the ability to work collaboratively as a team is beneficial to each other as well as TEPCO, IRID, and other stakeholders.
- The support provided by IRID and TEPCO is helpful and makes a strong contribution to enabling the IEG to work effectively.
- The support from Embassy personnel is also helpful, providing insights from personnel stationed full-time in Tokyo.

Specific IEG suggestions to improve the effectiveness of IEG meetings are provided below.

1. IRID, TEPCO, and IEG should work together to develop and implement an approach for the IEG members to remain involved and interacting with IRD and TEPCO in between IEG meetings. This will allow IEG members to be most effective as well as be conduits to other organizations in their countries.

2. The IRID and TEPCO presentations should be focused on conclusions, goals and the key supporting technical information. This will allow and encourage interaction and engagement. Many of the technical details from the presentations at this meeting were not necessary.

3. Minimize the use of video conference during IEG meetings.

4. Consider schedule adjustments to increase amount of face-to-face communication (for example, change from standard Tokyo, 2F, 1F, 2F, Tokyo schedule if it will improve effectiveness of meetings).

A
Principal Personnel Contacted

IRID

Mr.Hajimu YAMANA	Director General
Mr.Kazuhiro SUZUKI	Executive Director
Mr.Toshihiko FUKUDA	Director
Mr.Shunichi SUZUKI	Research Promotion Department Manager
Mr.Masahiro ECHIZEN	International and Alliance Department Manager
Mr.Shin TAKIZAWA	International and Alliance Department Deputy Manager
Mr.Kazuhito TAKEDA	International and Alliance Department Team Leader
Mr.Kosuke TAKAHASHI	International and Alliance Department
Mr.Naoto YAGI	International and Alliance Department
Mr.Akinori YAMAGUCHI	International and Alliance Department

TEPCO Head Office

Mr.Zengo AIZAWA	Vice President/Chief Nuclear Officer
Mr.Akio KOMORI	Fellow
Mr.John CROFTS	Nuclear Safety Oversight Office,Chief Officer
Mr.Naohiro MASUDA	Nuclear Safety Oversight Office,Deputy Chief Officer
Mr.Yasuhiro KUBO	Nuclear Safety Oversight Office
Mr.Jun MATSUMOTO	1F Project General Manager
Mr.Tomoyuki ARAI	1F Project, Comprehensive Strategic Planning Group
Mr.Hiroya SHIRAKI	1F Project, Environmental Assessment Group General Manager
Mr.Junichi TAIRA	1F Project, Environmental Assessment Group
Mr.Noriyoshi NAKAMURA	1F Project, Civil&Architectural Engineering Group General Manager
Mr.Yoshitaka HAGIWARA	1F Project, Civil&Architectural Engineering Group
Mr.Yoshiyuki SATO	1F Project, Civil&Architectural Engineering Group
Mr.Ritsuro TOKUMORI	1F Project, Defueling Strategy Group
Mr.Masayuki YAMAMOTO	Nuclear International Relations and Strategy Group Manager

TEPCO Fukushima Daiichi

Mr.Akira ONO	1F Site President
Mr.Takeshi TAKAHASHI	1F Stabilization Centre General Manager
Mr.Katsuhiko IWAKI	1F Stabilization Centre Deputy General Manager
Mr.Tomoaki SHIRAKAWA	1F Unit General Manager
Mr.Kazuo MOMOSE	Civil Engineering Department General Manager
Mr.Hiroyuki SHINOHARA	Civil Engineering Department
Mr.Seiji UENO	Architectural Department General Manager
Mr.Kazuo YAMANAKA	Radiation Management and Environment Department General Manger
Mr.Tomomi OKAMURA	Radiation Management and Environment Department
Mr.Shinji SAITOH	Cooling System Department General Manager
Mr.Takashi SATOH	Water Treatment System Department General Manager
Mr.Kazuo YASHIRO	Mechanical Equipment Department General Manager
Mr.Takashi HARA	Mechanical Equipment Department Manager
Mr.Toshimitsu TAMAI	Electrical Equipment Dpartment General Manager
Mr.Masahiro YAMAMOTO	Project Management Department General Manager

B
Meeting Agenda

(R7)2013/09/19

International Expert Group(IEG) Meeting

September 23 - 27, 2013

International Research Institute for Nuclear Decommissioning(IRID)

Agenda

Arrival Time of IEG Members

Schedule	
Dr.Adrian Simper	September 22nd PM15:35(NH0208), Narita Airport
Mr.Bob Coward	September 19th PM15:15(UA0803), Narita Airport
Dr.Joel Pijselman	September 23rd AM 6:30(JL042), Haneda Airport
Mr.Nikolai Steinberg	September 22nd AM10:30(SU260), Narita Airport
Mr.Anton Leshchenko	September 22nd AM10:30(SU260), Narita Airport
Hotel : Daiichi Hotel Tokyo	

Sunday, September 22, 2013 (Tokyo)

Location	Schedule	Participants
Restaurant (in the hotel)	19:00-21:00 Small dinner hosted by IRID (Restaurant "Enchante" in Daiichi Hotel Tokyo)	<IEG member> Adrian Simper Bob Coward Nikolai Steinberg Anton Leshchenko <IRID> Kazuhiro Suzuki Masahiro Echizen

Monday, September 23, 2013 (Tokyo, TEPCO HQs)

Location	Schedule and Agenda	Participants
Transfer	9:50 Meet at hotel lobby (Mr.Takeda) 9:50-10:00 Hotel => TEPCO HQs(walk)	
TEPCO HQs Meeting Room	10:00-10:45 Meeting with Secretariat	<IEG member> Adrian Simper Bob Coward Joel Pijselman Nikolai Steinberg Anton Leshchenko <Embassy Officials> <IRID secretariat> <TEPCO> Matsumoto
	10:45-11:30 Team Building Meeting 11:30-12:00 Preparation meeting - Framework of IRID,TEPCO and IEG	
	12:00-13:00 Working lunch	
	13:00-14:00 Preparation meeting - Framework of IRID,TEPCO and IEG - Decision process around contaminated water management - An emergency to planned normal situation -Operator/Regulator interface and interaction 14:00-15:00 International Public Offering Plans of Contaminated Water Measures by IRID	
Transfer	15:00-15:20 TEPCO HQs =>Ueno St.(Taxi) 16:00-18:08 Ueno St. => Iwaki St. (Express Super Hitachi #39)	
Restaurant in the hotel	19:00-21:00 **Dinner hosted by IRID**	IEG member IRID executives Interpreter

Hotel	Grandpark Hotel Panex Iwaki (Fukushima)	

Tuesday, September 24, 2013 (Fukushima Daini)

Location	Schedule and Agenda	Participants
Transfer	7:30-8:30 Hotel => Fukushima Daini (Bus)	
Fukushima Daini Meeting Room	8:45-9:30 **Entrance Meeting** - Self Introduction (IEG,IRID,TEPCO) - Remarks from IRID Chief Director - Remarks from IAT Alternate Chairman	IEG member Embassy Officials INSJ IRID executives IRID secretariat TEPCO executives TEPCO managers 1F executives 1F managers Interpreter
	9:30-11:00 **Background of IRID establishment, framework, organization and Positions of IEG/International Advisor (by IRID)**	
	11:00-12:00 **[Discussion Item 1] International Public Offering of Alternative Plans of Fuel Debris Removal** 1. Explanation from ERID -Introduction of the Scheme -Draft Specifications 2. QA and Discussion	
	12:00-12:30 Lunch	
	12:30-13:00 **IAT's Suggestions (IAT Report summary) (by IEG Mr.Bob Coward) (Mr.Aizawa (TEPCO CNO) attends through video link)** 13:00-13:30 **IAT's Suggestions and TEPCO's Management Policy (by TEPCO) (Mr.Aizawa (TEPCO CNO) attends through video link)**	
	14:00-17:00 **[Discussion Item 2] Contaminated Water Issues (Session A: Information Sharing and Deepening Understanding)** 1. Explanation from TEPCO (Overview, Latest conditions and Topics) - Overview - Latest Conditions and Countermeasures - Contaminated Water Leakage from Tanks 2. QA and Discussion	
Transfer	17:30-18:30 Fukushima Daini => Hotel (Bus)	
Hotel	Grandpark Hotel Panex Iwaki (Fukushima)	

Wednesday, September 25, 2013 (Fukushima-Daini, Fukushima-Daiichi)

Location	Schedule and Agenda	Participants
Transfer	7:30-9:20 Hotel=>J-Village(WBC) =>Fukushima Daini(Bus)	IEG member Embassy Officials INSJ IRID secretariat TEPCO managers Interpreter

Fukushima Daini Meeting Room	9:45-10:45 **Revised Roadmap and Progress (By TEPCO)**	IEG member Embassy Officials INSJ IRID secretariat TEPCO managers 1F managers Interpreter
	10:45-12:00 **[Discussion Item 4] Spent Fuel Handling and Disposition** 1. Explanation from TEPCO 2. Discussion	
	12:00-12:30 Lunch	
Transfer	13:00-13:40 Fukushima Daini=> Daiichi	
Fukushima Daiichi Site	13:40-17:00 **Site Tour of Fukushima Daiichi NPP** <Contaminated water issue areas> - Walkdown with Water Tanks Patrol Team - M4 well point, Trenches related to contaminated water issues <SF handling facilities> - Unit4 SFP and Cover - Dry Cask Facility	IEG member IRID secretariat TEPCO managers 1F site managers Interpreter
Transfer	17:00-19:00 Daiichi=>J-Village(WBC)=>Hotel	
Hotel Meeting Room	19:30-22:30 **Working Dinner (A meeting room with dinner to be booked in the hotel for team discussion)**	IEG member
Hotel	Grandpark Hotel Panex Iwaki (Fukushima)	

Thursday, September 26, 2013 (Fukushima-Daini)

Location	Schedule and Agenda	Participants
Transfer	6:45-7:45 Hotel => Fukushima-Daini(Bus)	IEG member Embassy Officials INSJ IRID secretariat TEPCO managers Interpreter
Fukushima Daini Meeting Room	8:00-10:00 **[Discussion Item 2] Contaminated Water Issues (Session B : Mid-Long Term Strategies)** - Discussion on middle/long term strategies and IEG's Advices =Example of Discussion Items= - Priority of Countermeasures - Possible Risks of Current Plans - Strategy of Risk Reduction etc.	IEG member Embassy Officials INSJ IRID secretariat TEPCO managers 1F managers Interpreter
	10:00-10:45 [Visit] Council Meeting for Decommissioning of Fukushima Daiichi NPS (The Government(METI)-TEPCO Joint Meeting)	
	10:45-13:00 **Team Meeting with Lunch**	IEG member IRID secretariat

	13:00-15:00 **Report to Site Executives/Management** 1. Report from IEG 2. Discussion 3. Closing Remarks from IEG Alternate Chairman	IEG member Embassy Officials INSJ IRID executives IRID secretariat TEPCO executives TEPCO managers 1F executives 1F managers Interpreter
Transfer	15:30-16:30 Fukushima Daini=>Iwaki St.(Bus) 17:20-19:36 Iwaki St.=>Ueno St. (Express Super Hitachi #58) Ueno St.=>Daiichi Hotel Tokyo(Taxi)	
Hotel	Daiichi Hotel Tokyo	

Friday, September 27, 2013 (Tokyo, TEPCO HQs)

Location	Schedule and Agenda	Participants
Transfer	8:50 Meet at hotel lobby(Mr.Yagi) 8:50-9:00 Hotel=> TEPCO HQs(walk)	
TEPCO HQs Meeting Room	9:00-12:00 **Team Meeting**	IEG member IRID secretariat
	12:00-13:00 Lunch	
	13:00-15:00 **Exit Meeting** 1. Report from IEG 2. Discussion 3. Closing Remarks from IEG Alternate Chairman	IEG member IRID executives IRID secretariat TEPCO executives (incl. CNO) and managers Embassy Officials Interpreter
	15:00-16:00 Press meeting(doorstepping)	IEG member IRID secretariat PR , SC members Interpreter
	16:00-17:00 **Meeting with Secretariat** 1.About Next IAT Meeting 2.Preparation for Press meeting 3.Miscellaneous	IEG member IRID secretariat PR , SC members Interpreter
Transfer	17:00- Back to Hotel	
Restaurant	19:00-22:00 **Dinner hosted by IRID**	IEG member IRID executives TEPCO executives (incl. CNO) Interpreter
Hotel	Daiichi Hotel Tokyo	

Departure Time of IEG Members

Schedule	
Dr.Adrian Simper	October 2nd AM 1:00(NH0203), Haneda Airport
Mr.Bob Coward	September 28th PM12:30(OZ0101), Narita Airport
Dr.Joel Pijselman	September 28th AM 0:40(JL041), Haneda Airport
Mr.Nikolai Steinberg	September 28th PM12:00(SU263), Narita Airport
Mr.Anton Leshchenko	September 28th PM12:00(SU263), Narita Airport

C
Exit Meeting Presentation

IRID International Expert Group

September 2013 IEG Meeting Summary

IEG Mission

The mission of the International Expert Group (the “IEG”) is to contribute to the safe and efficient implementation of the decommissioning of the Fukushima Daiichi Nuclear Power Station (the “Decommissioning”) and R&D activity for the Decommissioning, by providing advice to The International Research Institute for Nuclear Decommissioning (the ”IRID”).

The IEG shall provide such advice to IRID from an objective perspective based on the collective view of the IEG reflecting the differing international expertise and experience of each member of the IEG.

The IEG will provide IRID with recommendations on the specific issues faced at the Fukushima Daiichi NPS and the specific issues of Research & Development for decommissioning

Summary Comments

- A good visit and good meeting
- Organization changes (formation of IRID, METI increased involvement) provide a potential foundation for improved effectiveness
- Key challenges remain to be:
  - Stakeholder engagement and education
  - Prioritization of activities
  - Definition of Interim and End States (to guide activities)
  - Organizational alignment and effectiveness

There are technical challenges to execute the Fukushima decommissioning - right now the organizational and stakeholder challenges are more significant and more important

Summary Comments

- Developing and maintaining public confidence is vital
  - Commitments must be met
    - Commitments must be within the capability of delivering organization
    - Top down goals must be validated by bottom up planning
    - The amount of work must be reasonable (this will require some hard choices to prioritise)
  - TEPCO, IRID and METI must be partners supporting each other
- There is a hierarchy to defining priorities and work:

  policy -> supporting strategies -> implementation plans
- Policy and regulation needs to respond to realities of the situation
- 1F is no longer a nuclear power plant site, it is a nuclear decommissioning site

Formation of IRID

- Observations:
  - Goals and vision for IRID are good
  - There is a need for clarity in organizational roles, responsibility, and accountability between TEPCO, IRID, and METI
    - They need to be understood by everyone
  - Achieving the new way of working will require significant investment of time and focus
- IEG recommendations will include suggestions on how to develop and ensure clear division of responsibility between TEPCO, IRID, and METI
  - For example: regular assessments to determine if adjustments are needed

Fuel Debris Removal R&D Solicitation

- Observations:
  - Objectives to engage international organizations, and to engage with them early are good
  - Plan to consider options other than flooded PCV is good
  - Planned approach could create risk that the number of responses will be low and not from organizations with the right experience and capabilities
    - Concerns about ownership of Intellectual Property
    - Concerns about whether this process will create a real opportunity for market
    - Concerns about Japan's history as a closed market
    - Concerns about time scale for process
- IEG recommendations will focus on communication with potential responders to ensure they understand long term plan and will engage with IRID
  - For example, engagement with selected companies in advance to discuss their concerns and reinforce the reasons they should participate

Contaminated Water

- Observations:
  - IEG does not see immediate threat to people or environment
    - Emergency actions are not required
    - Situation highlights need for improved communications
  - Three objectives:
    - Reduce risk of contamination to ocean
    - Lower water levels in Reactor and Turbine Buildings
    - Reduce amount of water to be treated and stored
- Priorities/Recommendations:
    - Trench remediation
    - Subdrain functionality
    - Groundwater bypass
    - Options for reduction of cooling water flow

Additional Comments

- Ice Dam
  - We understand the objectives of the ice dam
  - It is important to evaluate in detail the feasibility and impact
    - Need to understand impact on groundwater flow, building stability, and soil conditions
    - Physical trials and testing are essential
  - Implementation schedule should be decided based on site conditions after restoring subdrains and implementing groundwater plus results of physical trials and testing
- Shield Wall
  - We understand the objectives of the shield wall
  - It is important to evaluate further:
    - Potential for unintended consequences on ground water flow
    - Potential for concentrating contamination in one location
    - How to handle and manage a large volume of contaminated soil and water

Tank Farm

- Observations:
  - Existing situation is not ideal
    - Leaks likely
    - Low margins
  - Objective is to remove risk of contamination from tanks
- Priorities/Recommendations:
  - Ensure adequate storage capacity
  - Accelerate additional ALPS capacity
  - Mitigate risks of leaks – pursue spare tanks
  - Replace bolted tanks
  - Replace horizontal tanks
- Note:
  - Replacing tanks does not reduce risk of piping leaks
  - Discharge of treated water creates immediate capacity
    - IEG sees no safety or environmental reasons preventing discharge

Roadmap

- Observations:
  - Building public confidence is critical
    - The Roadmap should be relative stable, defining key policy items and the important Interim and End States
    - Roadmap dates should be realistic and achievable
  - The Roadmap plays a role in establishing public confidence and guiding the program
- IEG Recommendations will focus on actions to increase stakeholder confidence in the Roadmap and improve it's use as a guidance document
  - For example, top down date goals should be validated from a bottom-up approach

Spent Fuel Removal

- Observations:
  - Good progress preparing Unit 4 for spent fuel removal
  - Overall plan appears optimistic
    - Seems to assume “normal” operation type experience
    - Issues with damaged fuel and racks will occur more than anticipated
  - Removal of fuel from Unit 4 and moving fuel from Common Pool to casks must be coordinated to ensure sufficient space in the Common Pool
- IEG Recommendations will focus on increasing the robustness and confidence of the overall plan for spent fuel removal
  - For example, this is a high risk activity - IEG would like to engage with TEPCO to review the plans in detail, including failure analyses

Site Visit

- Observations:
  - Progress can be seen, for example:
    - Unit 4 spent fuel removal structures and equipment
    - Removal of rubble from Unit 3 reactor Building
    - Site access
  - Radiation protection practices seem overly conservative
    - Increase worker risks (increased risk of industrial incidents)
    - Decrease worker productivity
    - Sends unintended messages to broad community
  - Efforts still needed to get out of emergency mode
- IEG recommendations will focus on practices to improve worker efficiency as well as reduce overall worker risk (radiological and industrial) and worker burden

Priority Work Programmes

Operator

1. Trenches
2. Sub Drains
3. Groundwater Bypass
4. Tank Farm management
5. ALPS capacity
6. Cooling water reduction and installation of local water treatment
7. Unit 4 Spent Fuel removal
8. Unit 3 Spent Fuel removal

Strategy and Policy

1. National waste policy
2. Regulatory environment suitable for realities of decommissioning
3. Stakeholder engagement and building public confidence

IEG Operations

- Observations:
  - IEG is coming together as a team – complementary skills and experience are beneficial
  - IRID and TEPCO support is helpful
  - Embassy engagement is helpful
- IEG recommendations will focus on improving the effectiveness of IEG meetings

Key IEG Recommendations (to IRID, METI & TEPCO)

- Review the priorities for Contaminated Water countermeasures and adjust work plan
  - Align actions with goals and priorities
  - Reduce risk of unexpected consequences
- Improve expectation management
  - Improve engagement with stakeholders to improve understanding of risks
  - Ensure internal work schedules have margin compared to external schedules
- Improve clarity of organizational roles and responsibilities among TEPCO, METI, IRID and other key organizations
  - Ensure Division of Responsibilities of all parties is communicated and understood
  - Ensure priorities are shared, understood, and communicated
- Progress on defining Interim and End States is critical
  - Provide direction for ongoing activities
  - Requires addressing national policy questions
- Perform readiness review of plans and bases for performing Unit 4 spent fuel removal
  - Include outside participation for independence (including IEG)

Looking Ahead – Next IEG Meeting

- At next meeting, IEG desires to engage on:
  - Roadmap, in particular Interim and End States to be included in next revision
  - Development of IRID
  - Design processes
  - Fault scenarios for fuel removal
  - Fuel debris removal