ENCLOSURE 6

STAKEHOLDER INTERACTIONS

Contents

Stakeholder Interactions

1.0 Introduction

To better inform its regulatory analysis, the staff conducted ten public meetings with stakeholders to better understand their views and obtain feedback on severe accident and filtered containment venting. Summaries of meetings related to severe accident and filtered containment venting are provided in this enclosure.

2.0 Public Meetings

2.1 December 15, 2011

Purpose: The purpose of this meeting was to begin discussions with stakeholders on implementation strategies the NRC was considering taking to address Recommendation 5.1, Reliable Hardened Vents, of the Near-Term Task Force (NTTF) Recommendations. The meeting focused on a general approach and introduction to the implementation of this recommendation.

Summary: The staff provided an overview of the Fukushima accident, describing the difficulty that plant operators faced when attempting to vent the containments at Units 1, 2 and 3. The staff noted that ensuring that BWR Mark I and Mark II containments have reliable hardened venting capability would have a significant safety benefit. In addition the staff indicated that it was considering the idea that the reliable hardened venting system be equipped with a filter to preserve the containment function as a barrier to fission products. Representatives from the BWR Owners' Group stated that it was looking into alternative approaches to filtering, and the staff recommended that the BWROG provide any insights into the alternatives to an external filter as soon as possible.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML11348A100
Stakeholder Presentation Slides - ML11353A002 (BWROG)

2.2 January 17, 2012

Purpose: The purpose of this meeting was to continue discussions with stakeholders on implementation strategies the NRC was considering taking to address Recommendation 5.1, Reliable Hardened Vents, of the Near-Term Task Force (NTTF) Recommendations. The meeting focused on hardened vent performance requirements and implementation of this recommendation.

Summary: The NRC staff provided an update since the previous meeting, including an accelerated schedule for all Tier 1 NTTF recommendations to be issued by March 9, 2012, as well as the NRC Japan Lessons Learned Steering Committee decision that additional information is needed on potential filters for the reliable hardened vent for applicable licensees. The Steering

Committee has asked the NRC staff to prepare a policy issue paper which will be presented to the Commission for a notation vote by the summer of 2012 relating to the filtered vent issue. The staff also outlined its current views relating to possible new regulatory requirements for reliable hardened vents.

The industry and BWROG representatives presented their proposed response to the December 15, 2011, public meeting related to a hardened filtered vent in the terms of two distinct phases. Phase 1 would employ a reliable hardened vent integrated with the Nuclear Energy Institute's (NEI) "Integrated, Diverse & Flexible Mitigation Capability" (FLEX) initiative. Phase 2 would focus on a post-core damage response strategy to reliably vent containment and manage radiological release for an extended station blackout.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12013A230
Stakeholder Presentation Slides - ML12019A122 (BWROG)
Meeting Summary - ML12025A020

2.3 May 2, 2012

Purpose: The purpose of this meeting was to discuss the implementation of Order EA-12-050, regarding reliable hardened containment vents at BWR facilities with Mark I and Mark II containments. The staff also discussed development of interim staff guidance (ISG) relating to this order that was to be issued by August 31, 2012, and the staff requested input from stakeholders regarding the implementation of order requirements. In addition, the staff sought input relating to the issue of filtered vents as described in SECY-12-0025, "*Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami*," issued February 17, 2012.

Summary: The NRC staff provided an overview of the plan to issue the ISG for Order EA-12-050 no later than August 31, 2012. The staff provided a general outline of the draft ISG contents: (1) definitions, (2) administrative requirements, (3) reporting requirements, and (4) NRC staff positions on each of the order's technical requirements. The NRC staff reviewed each of the order's administrative, reporting, and technical requirements, and presented preliminary staff viewpoints on each of the requirements.

The issue of early containment venting was noted as a particular interest to the BWROG, and the owner's group was interested in learning whether or not the NRC staff has changed its views on containment venting as a "last resort" in light of the lessons learned from Fukushima. The staff noted that any changes to Emergency Procedure Guidelines would likely have to be reviewed by the NRC staff prior to implementation.

The NRC staff sought input and comments from members of the public and non-governmental organization representatives on the issue of filtered containment vents. The staff noted that the Commission directed the staff in SRM-SECY-11-0137, to address the issue of 'Filtration of Containment Vents' in conjunction with the Tier 1 issue on hardened vents for Mark I and Mark II containments. The introduction of this issue prompted numerous comments from members of the public. Examples included: (1) concerns as to why the NRC did not require the vents to be able to handle severe accidents and the presence of hydrogen gas following a severe accident; (2) many considered containment vent filters an obvious solution and stated that filters should be made a requirement to ensure that the containment is able to "do what it is suppose to do;" (3) another person commented that filtered vents should be required because operators never know when core damage really begins; (4) the NRC is not serving the public interest by assuming no core damage is present with the hardened vents that were ordered by the NRC in March.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12124A132
Stakeholder Presentation Slides - ML12124A130 (BWROG)
Meeting Summary - ML12130A369

2.4 May 14, 2012

Purpose: The purposes of this meeting were to brief stakeholders on the staff's preliminary plans for implementation of the Tier 3 recommendations, provide an opportunity for stakeholders and the NRC staff to exchange information on the Tier 3 recommendations, afford stakeholders an opportunity to ask the NRC staff clarifying and amplifying questions on the plans, and provide input for consideration before the plans were finalized. The staff also gave a presentation on information gathered for Recommendation 5.1, "Reliable Hardened Vents for Mark I and II Containments." The public had an opportunity to comment and discuss the recommendation following each individual staff presentation.

Summary: Some audience and teleconference members felt very strongly about requiring filters for Mark I and II containments, and urged the staff to permanently shutdown boiling-water reactors with Mark I and II containments if filters were not installed. Another audience member encouraged the staff to think beyond the hardened filtered vent systems that some European nations had installed in the 1980s. A Nuclear Energy Institute (NEI) representative indicated that hardened, filtered ventilation was a complex topic, and that it was more important to do it right, rather than quickly. Accordingly, NEI would be sending a letter to the Commission requesting that staff perform a more comprehensive analysis that considers other alternatives for precluding and mitigating potential releases from core damage events, and credits safety improvements being installed under FLEX.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12137A008
Stakeholder Presentation Slides - N/A
Meeting Summary - ML12160A097

2.5 July 12, 2012

Purpose: The purpose of this meeting was to discuss testing programs and technology developments on wet and dry filtered containment venting systems (FVCS) with Dr. Bernd Eckardt, AREVA NP Canada LTD. AREVA provided information to the staff on European and world experience relating to FCVS since the late 1980s.

Summary: Representatives from AREVA NP Canada opened the technical discussions by providing an overview of FCVS at Canada's CANDU nuclear plants. CANDU plants have containment structures that are similar in design to large dry containments in the U.S.; however, the use of FCVS technology is also applicable to BWR Mark I and Mark II containment designs. Additional details of the FCVS system installed at Point Lepreau were also provided.

AREVA presented information about FCVS technology and historical developments since the 1980s. AREVA also discussed the issue of the "filter gap." The filter gap issue is primarily concerned about the filter's ability to retain particles less than one micron in size. AREVA stated that, depending on the particle diameter, a filter's retention efficiency has been shown to vary. He added that every type of filter technology appears to have a "filter gap" where lower removal efficiencies are observed for particles of a particular size. As a result, filter engineers have designed ways to overcome concerns relating to the filter gap in order to achieve improved particle retention.

AREVA discussed the development of scrubbers, filters, sorbents, media, standards and new liquid agents from a historical perspective of the development of FCVS since the 1980s. The principles of venturi scrubbing were presented, including the engineered features being employed by filter designers to eliminate the filter gap. AREVA further explained that rigorous testing was performed in order to verify aerosol retention capabilities and that very high decontamination factors (DFs) have been verified by thousands of laboratory tests under prototypical operating conditions. An AREVA representative stated that filters have achieved efficient retention (high DFs) of large and fine aerosol fractions for aerosols (fine Aerosols > 10,000 and large Aerosols > 100,000) during ACE/JAVA testing. AREVA also presented information on dry filter technology including metal fiber and sand bed filters.

Following the formal presentations and discussions on filtered containment venting technology, the NRC staff sought input and comments from members of the public and non-governmental organization representatives.

Related ADAMS Documents:

NRC Staff Presentation Slides - N/A
Stakeholder Presentation Slides - ML12206A263 (AREVA - Dr. Eckardt)
ML12206A266 (AREVA NP Canada)
Meeting Summary - ML12319A530

2.6 August 8, 2012

Purpose: The purpose of this meeting was to discuss with the Electric Power Research Institute (EPRI), industry representatives, and members of the public to the results of industry's analysis and assessment of possible severe accidents in BWRs with Mark I and Mark II containments using various codes and models for radiological releases. In addition, the staff discussed the role of uncertainty in risk-informed decision making.

Summary: EPRI provided an overview and preliminary results of the research efforts that were later documented in its September 25 report. EPRI provided preliminary information relating to computer modeling and preliminary evaluation of strategies for mitigating radiological releases during severe accidents at BWRs with Mark I and II containments.

The EPRI report evaluates certain strategies that are intended to maintain or enhance the containment function in scenarios involving long-term loss of electric power. The strategies evaluated include water injection (by flooding or spraying), alternative containment heat removal, venting, controlled venting, filtered venting, and combinations of these plant features. Based on the results of its research, EPRI noted seven "key insights" from the analysis, including:

- No single strategy is effective
- Active core debris cooling is required
- Existing severe accident management guidelines (SAMGs) strategies provide substantial benefit
- Spraying the containment atmosphere is beneficial
- Venting prevents uncontrolled release and manages hydrogen
- Control of the vent provides benefit
- Low-efficiency filters can further reduce radionuclide releases

The staff was in general agreement with many of EPRI's insights; however, many concerns remained about strategies that use existing containment features and their ability to achieve a dependable and adequate decontamination of radionuclides following a severe accident.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12229A303
Stakeholder Presentation Slides - ML12229A293 (EPRI)
Meeting Summary - ML12233A085

2.7 September 4, 2012

Purpose: The purpose of this meeting was to discuss testing programs and technology developments on filtered containment venting systems (FVCS) with representatives from the Paul Scherrer Institute (PSI), Villigen, Switzerland. PSI is a multi-disciplinary research organization that has considerable experience relating to research and development of FCVS.

Summary: IMI Nuclear (IMI) is a supplier of filters for containment venting applications and has a working relationship with PSI. IMI opened the meeting with discussions on (1) venturi scrubbing, (2) metal fiber filtration, and (3) iodine adsorption by molecular sieve based adsorbents. IMI representatives then provided their perspectives on the suitability of these technologies for filtered venting applications. IMI also contrasted the aerosol removal performance of the CCI FCVS (CCI is affiliated with IMI Nuclear). One of the more notable features of the CCI FCVS is its sparger assembly. The spargers operate by directing a fraction of the airstream from the nozzle to an opening with a restricted flow path. Larger aerosol particles enter the nozzle opening, forming a "virtual surface," to become entrained in a minor flow of aerosols at a reduced velocity. Smaller aerosol particles follow the major flow and are ultimately captured in the liquid. This process is repeated two more times in the nozzle. IMI stated that mockup testing produced extremely high DF of aerosols, and iodine species under all conditions.

Representatives from PSI presented information about its experience in the area of FCVS technology and provided a short history of PSI's knowledge in aerosol and iodine research. During the 1980s PSI participated in the LACE and DEMONA tests and development of on-line aerosol concentration measurement devices and LOFT research. PSI also supported development of Sulzer's FCVS during this time. In the 1990s, PSI performed aerosol research (aerosol generation by plasma, POSEIDON pool scrubbing, GE-SBWR PCCS and SIEMENS SWR100 PCCS behavior testing). More recently, PSI has conducted further research and development in the area of FCVS technology: ARTIST project studying aerosol and droplet retention in steam generators, qualification tests for CCI-FCVS, severe accident safety studies for Swiss plants in support of PSA, hydrogen behavior in containments (PANDA), and research on aerosol behavior to support IMI (CCI-AG) for demonstration of FCVS performance under utility specified conditions.

Related ADAMS Documents:

NRC Staff Presentation Slides - N/A
Stakeholder Presentation Slides - ML12248A019 (Paul Scherrer Institute)
ML12248A021 (IMI Nuclear)
Meeting Summary - ML12319A541

2.8 September 13, 2012

Purpose: The purpose of this public meeting was to discuss initial results from the NRC staff's analysis of various strategies or methods to manage radiological releases following a severe accident in BWR Mark I and Mark II containments. Discussions focused on the staff's use of severe accident analysis codes such as MELCOR in the assessment of severe accident progression. Scenarios with various containment venting, spraying, and flooding strategies were discussed. The staff also allotted a significant portion of the meeting agenda to allow representatives from public interest groups to provide technical insights relating to the issue of filtered containment venting.

Summary: Members of the NRC staff from the Office of Nuclear Regulatory Research (RES) provided an overview of severe accident management and containment venting, and strategies to protect containment and limit radiological releases. RES then discussed the analysis it performed using MELCOR. The purpose of the MELCOR analysis is to support the regulatory analyses on filtered venting. The filtered venting regulatory analysis will draw upon the results of MACCS calculations based on representative MELCOR cases. The MELCOR cases focused on Mark I containments, and were informed by Fukushima and SOARCA. This information was then used to perform MACCS consequence calculations using MELCOR output.

David Lochbaum, Director, Nuclear Safety Project, Union of Concerned Scientists (UCS), made a presentation regarding filtered venting. UCS noted that radioactive releases during routine operations and design basis accidents are filtered through the standby gas treatment system (SGTS); however, radioactive releases during severe accidents are not filtered. UCS's argument is that, when the highest amount of radioactivity is likely present, the lowest protection to plant workers and members of the public is provided. In addition, UCS noted that there is a large uncertainty associated with the analysis of severe accident progression and modeling.

Mary Lampert, Director, Pilgrim Watch (PW), then presented information on its perspectives of filtered venting. PW recommended that hardened vents now required by Order EA-12-050 be equipped with rupture discs and filters to help ensure that operators are not reluctant to follow orders when containment venting is required. PW stated that an unfiltered vent releases up to 200 times more radioactivity than do commercially available filtered systems now being used in Europe. The PW presentation turned to the issue of how offsite consequences are being calculated. PW stated that MACCS2 under predicts or understates the consequences of a severe accident. One of the primary concerns stated is that MACCS2 does not calculate consequences of aqueous releases. PW was also concerned about the analysis assumptions, such as core damage frequency, when the NRC staff performs its cost-benefit calculations. PW requested that the staff review the reports it provided to the NRC (see ADAMS Accession Numbers below).

Mr. Mark Leyse spoke on behalf of the National Resources Defense Council (NRDC), and raised concerns relating to the NRC staff's analysis. NRDC

stated that, in a BWR severe accident, “hundreds of kilograms of non-condensable hydrogen gas would also be produced (up to over 3000 kg) - at rates as high as between 5.0 and 10.0 kg per second, if there were a reflooding of an overheated reactor core - which would increase the internal pressure of the primary containment. If enough hydrogen were produced, the containment could fail from becoming over-pressurized.” NRDC recommended the installation of high capacity filtered containment venting systems in order to accommodate the potentially high production of hydrogen during an accident.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12256A849

Stakeholder Documents - ML12254A871 – Pilgrim Watch Document #1
ML12254A869 – Pilgrim Watch Document #2
ML12254A865 – Mark Leyse (NRDC) Document #1
ML12254A850 – Mark Leyse (NRDC) Document #2

Stakeholder Presentation Slides - ML12256A913 - UCS Presentation Slides
ML12256A853 - Pilgrim Watch Presentation Slides

Meeting Transcript - ML12320A324
Meeting Summary - ML12319A545

2.9 October 4, 2012

Purpose: The purpose of this meeting was to hold follow-up discussions to the public meeting held on September 13, 2012. The staff discussed the results from its analysis of various strategies or methods to manage radiological releases following a severe accident in BWR Mark I and Mark II containments. Discussions focused on the use of MELCOR and MACCS in the staff’s regulatory analysis, probabilistic risk assessment insights, and initial regulatory analysis insights. The staff also provided opportunities for members of the public to provide technical insights relating to the issue of filtered containment venting.

Summary: As part of its follow up to presentation and discussions of the MELCOR analysis during the September 13, 2012, public meeting, the NRC staff presented material on the following topics: (1) design and regulatory history, and foreign experience, (2) FCVS in severe accident management, (3) MELCOR analysis, (4) MACCS2 analysis, (5) risk evaluation, (6) regulatory analysis, and (7) qualitative arguments. The staff noted that technical and policy assessments and evaluations were ongoing, and that the preliminary results being shared at the meeting were subject to change. In addition, the NRC staff stated that it would be continuing to engage the NRC’s Steering Committee on path forward, and that staff recommendations will be made when technical evaluations and policy assessments were completed.

Related ADAMS Documents:

NRC Staff Presentation Slides - ML12283A288
Stakeholder Presentation Slides - N/A
Meeting Summary - ML12319A547

2.10 October 11, 2012

Purpose: The purpose of this meeting is to discuss testing programs and technology developments on filtered containment venting systems (FVCS) with representatives from the Westinghouse Electric Company (WEC). Westinghouse has considerable experience relating to research and development of FCVS.

Summary: The NRC staff opened the meeting with a brief update on the status of its effort to evaluate the merits of severe accident and filtered containment venting. Representatives from WEC then presented information on its two proven filtered containment venting technologies: (1) FILTRA - MVSS (venturi based scrubber system) and (2) dry filter method (DFM) system. The Westinghouse FILTRA program has been developed in conjunction with Alstom Thermal Power. Alstom is a provider of equipment and services to various power generation and rail transportation companies. The FILTRA MVSS technology has been installed in all Swedish BWRs and PWRs and at one Swiss BWR. The DFM technology has been installed at seven German PWR facilities. Both designs were included in the ACE testing in the 1980s. WEC most recent developments in FCVS technology includes: (1) high DF >10,000 for aerosols, (2) the scrubbing of aerosols down to 0.5 microns, (3) protection against iodine release (both elemental and organic), (4) passive operation for at least 24 hours, and (5) the ability to handle relatively high decay heat loads in its filter designs.

Related ADAMS Documents:

NRC Staff Presentation Slides - N/A
Stakeholder Presentation Slides - ML12312A110 Westinghouse Technology Overview
ML12312A111 MVSS (Wet Filter) Technology
ML12312A112 DFM (Dry Filter) Technology
Meeting Summary - ML12319A549