umweltbundesamt

ETE Road Map

According to Chapter IV and V of the
"Conclusions of the Melk Process and Follow-Up"

Item 2
Qualification of Valves

Final Monitoring Report

Report to the Federal Ministry of Agriculture,
Forestry, Environment and Water Management
of Austria

Vienna, May 2005

seibersdorf research

Institut für Risikoforschung
der Universität Wien

umweltbundesamt

ETE Road Map

According to Chapter IV and V of the
"Conclusions of the Melk Process and Follow-Up"

Item 2
Qualification of Valves

Final Monitoring Report

Report to the Federal Ministry of Agriculture,
Forestry, Environment and Water Management
of Austria

Vienna, May 2005

seibersdorf research

Institut für Risikoforschung
der Universität Wien

Project Coordination

Katja Lamprecht
(Umweltbundesamt – Federal Environment Agency – Austria)

Layout

Claudia Kubelka
(Umweltbundesamt – Federal Environment Agency – Austria)

Technical Project Management

Werner Erath (Kerntechnik Entwicklung Dynamik – Germany)
Emmerich Seidelberger (Institute of Risk Research, University of Vienna – Austria)
Geert H. Weimann (ARCS Seibersdorf Research – Austria)

Technical Support from

Werner Erath (Kerntechnik Entwicklung Dynamik – Germany)
Bernd Nowotny (Kerntechnik Entwicklung Dynamik – Germany)
Antonio Madonna (Consultant – Italy)
Helmut Hirsch (Consultant – Germany)
Steven Sholly (IRR – Austria)
Gueorgui Kastchiev (IRR – Austria)

The organisations and individuals listed below **"Technical Project Management"** have provided computing support, technical analyses, and technical support to the Technical Project Managers during the course of the project, and their valuable contributions are acknowledged.

IRR-ARCS share jointly responsibility for the Final Monitoring Report (FMR), including its contents and conclusions. No attribution of responsibility for the contents and conclusions of the FMR to the above-listed organisations and individuals is intended or implied.

This Information is supplied on the condition that any person receiving this Information will make her own determination as to its suitability for any purpose prior to any use of this information. In no event IRR-ARCS and/or the above-listed organisations and individuals or its subsidiaries will be responsible for damages of any nature whatsoever resulting from the use of or reliance upon this information or any product referred to in this information.

At the same time, this Information is not to be construed as recommendation to make use of any information, product, process, equipment, or formulation in practice that conflicts with any patent, copyright, or trademark, and IRR-ARCS and/or the above-listed organisations and individuals or its subsidiaries do not make any representation or warranty, expressed or implied, that any use of this Information will not infringe on any patent, copyright, or trademark.

The present report is financed by the Federal Ministry
of Agriculture, Forestry, Environment and Water Management of Austria.

Masthead

Editor: Federal Environment Agency Ltd.
Spittelauer Lände 5, 1090 Vienna, Austria

In-house reproduction

ISBN 3-85457-781-8

Note to the Reader

The report is published on the Temelín homepage provided by the Federal Environment Agency at http://www.umweltbundesamt.at.

Should you encounter technical problems, please do not hesitate to contact mailto: marlene.engel@umweltbundesamt.at.

EXECUTIVE SUMMARY

The Republic of Austria and the Czech Republic have, using the good Offices of Commissioner Verheugen, reached an accord on the "Conclusions of the Melk Process and Follow-up" on 29 November 2001. In order to enable an effective use of the "Melk Process" achievements in the area of nuclear safety, the ANNEX I of this "Brussels Agreement" contains details on specific actions to be taken as a follow-up to the "trialogue" of the "Melk Process" in the framework of the pertinent Czech-Austrian Bilateral Agreement.

Furthermore, the Commission on the Assessment of Environmental Impact of the Temelín NPP – set up based on a resolution of the Government of the Czech Republic – presented a report and recommended in its Position the implementation of twenty-one concrete measures (ANNEX II of the "Brussels Agreement").

A "Roadmap" regarding the monitoring on the technical level in the framework of the pertinent Czech-Austrian Bilateral Agreement as foreseen in the "Brussels Agreement" has been elaborated and agreed by the Deputy Prime Minister and the Minister of Foreign Affairs of the Czech Republic and the Minister of Agriculture and Forestry, Environment and Water Management of the Republic of Austria on 10 December, 2001.

The Federal Ministry of Agriculture, Forestry, Environment and Water Management entrusted the Umweltbundesamt (Federal Environment Agency) with the general management of the implementation of the "Roadmap". Each entry to the "Roadmap" corresponds to a specific technical project (see ANNEX IV). For each project an own international experts team was ordered by the Umweltbundesamt to accomplish the related work. For the project considered the Institute of Risk Rresearch at the University of Vienna and the Austrian Research Center Seibersdorf were selected as leaders of this experts team.

Item No. 2 "Qualification of Valves" of ANNEX I of the "Brussels Agreement" covers the functional qualification for Two-Phase and Water-Flow of the main steam relief (BRU-A) and safety valves (MSSV or SGSV) at the + 28,8 meter level of the intermediate building of the Temelín NPP. The objective regarding this item as stated in ANNEX I of the "Brussels Agreement" is the "Demonstration of reliable function of key steam safety and relief valves under dynamic load with mixed steam-water flow."

The Specialists' Workshop as specified in "Roadmap" was held in Prague in the 2nd half of 2002 to discuss this issue.

The approach by the Czech Side

The key element in the monitoring process was a joint Specialists' Workshop on the "Roadmap" item No. 1 "HELB" and "Roadmap" item No. 2 "Qualification of Valves" (PN 3) conducted in Prague on 7 and 8 November 2002 in the framework of an additional specialist meeting according to Article 7 (4) of the Pertinent Bilateral Agreement of the Exchange of Information on Nuclear Safety. In view of the interrelation of the two issues, the Czech hosts deemed it useful to treat both items at the same workshop. The analysis of the information made available there is in essence the basis for the present Final Monitoring Report of the Austrian Experts' Team.

The main steam relief and safety valves functional qualification was addressed by the Czech Technical Support Organisation and the Regulatory Authority SÚJB at the Specialists' Workshop and in the framework of the information provided during the pipe integrity related presentations (see project PN2) within the broad scope of the "Comprehensive Safety Case Revisit" (CSCR). The Regulatory Authority SÚJB has for the time being accepted the results

of the valves functional qualification preliminarily. With some equipment replacements and based on "new qualification files", the results of the CSCR are accepted as confirming and endorsing the original decisions of the regulatory authority.

Information about the following main areas was presented by the Czech TSO and the Regulator and discussed at the Specialists' Workshop:

- Parent Valves: BRU-A and MSSV Functional Qualification for Water and Steam-Water Mixture
- Extension of the Functional Qualification of Parent Valves to Temelín Candidate BRU-A and MSS Valves applying ASME-QME-1-1994, QVC valves-similarity approach
- Environmental Qualification of BRU-A Actuator
- Replacement of MSSV Pilot Valves and of Electric Motor Drives of BRU-A Valves

The approach ČEZ a.s. as operator of Temelín has taken to resolve the safety issue "Qualification of main steam relief and safety valves" (as approved by SÚJB) is the application of the ASME Code procedure ASME QME-1-1994, QVC. This procedure is based on the similarity of functionally tested "parent" valves and the "candidate" valves. According to this procedure those valves used in the Temelín NPP are to be considered as "candidate" valves. Their functional qualification was intended to be achieved by extension of the qualification procedure of similar "parent" valves to the "candidate" valves of Temelín. These "parent" valves should have already passed a functional qualification test successfully and should have been designed by the same Company. SÚJB has accepted this specific approach taken by ČEZ a.s and its TSO as an application of the ASME Code procedure mentioned above, used for the qualification for water and two-phase flow (steam and water at the same time).

The descriptions at the workshop did provide information about the approach taken. However, due to the overview type presentation only limited insight into the results and how these were obtained was possible. Several questions remained open. As a consequence, both sides agreed that the pertinent Czech-Austrian Bilateral Agreement is the appropriate framework giving the opportunity for further discussion and sharing additional information on these issues.

The approach of the Austrian Specialists' Team

An Austrian Experts' Team of five international experts was committed by the Umweltbundesamt (Federal Environmental Agency) on behalf of the Austrian Government to give technical support for the monitoring on the technical level of the implementation of the Valves Issue as listed in ANNEX I of the Conclusions of the Melk Process and Follow-up. This specific technical project is referred as project PN3 comprising altogether seven predefined "project milestones" (PM).

In a **first step** (Project Milestone 1 – PM1), the safety objective was broken down to Verifiable Line Items (VLIs), in order to focus preparatory work of the Austrian Experts' Team and to guide the Austrian Delegation through the Specialists' Workshop, but also to enable proper preparation of the Specialists' Workshop on the bilateral level (see ANNEX A). The VLIs were based already on the ASME similarity concept[1], because the Czech approach was principally known from preceding discourses.

[1] If at least two valves of different dimensions but of the same family (valves having the same configuration) are functionally qualified by physical testing, then another valve of a family deduced from the parent family, but in principle of identical configuration can also be assumed to be functionally qualified under specific requirements without the physical testing prescribed.

In a **second step** (PM2) the Austrian Experts' Team prepared a list of documents (PM2) – the Specific Information Request – SIR, considered to contain the kind of Information required to provide profound answers to the VLIs (see ANNEX C).

The **third step** in the preparatory work for the Workshop also included identification of Standards and practices applied for the Valves' issue within the European Union Member States. A special focus was the practice in Germany, since it has devoted considerable resources to analyse valves' behaviour. In the Briefing to the Austrian Delegation (PM3) these elements of the monitoring were presented to the mission participants.

At the Specialists' Workshop on HELB and Qualification of Valves in Prague on 7 and 8 November 2002, experts from the plant operator, technical support organisations, and the licensing authority made fifteen well-prepared slide beamer presentations, one of which was particularly devoted to the Qualification of Valves PN3 issue, characterised by one Czech presenter as being of overview nature. Within the limitations spelled out above most questions by the Austrian Specialists' Team were answered during the Specialists' Workshop.

Following the Workshop in the **fourth step** (PM4), the Austrian Experts' Team reviewed the Specialists' Workshop and the Team members provided contributions to the Preliminary Monitoring Report (PMR).

The contributions of the Austrian Experts' Team members have been merged by the Technical Project Management to provide the technical basis for the Preliminary Monitoring Report (PMR, project milestone PM4). This technical basis was reviewed and commonly agreed in an internal workshop of the Austrian Specialists' Team held on 8 to 9 December 2002 in Vienna.

The evaluations in the PMR addressed three different levels of the process by commenting:

- on the adequacy of the information available from the presentations in view of the monitoring task and
- on the adequacy of the technical approach as such
- on issues directed towards a resolution of the safety issue addressed and on its interrelation to the items of projects PN2: "High Energy Pipe Lines at the 28,8 m Level" and PN4: "Qualification of Safety Classified Components" .

In a **fifth step** the Austrian side presented to the Czech side a summary of the valves´ issue monitoring and the related main findings at the Bilateral Meeting on December 18, 2003. The discussion with the Czech partner resulted in no new information.

The **sixth step** in the monitoring process of PN3 "Valves´Qualification" was to set up the Final Monitoring Report (FMR), which is presented herewith.

Monitoring Process Results

The Monitoring process so far helped to clarify a number of VLIs. Based on the information currently available, the Austrian Experts' Team formulates its view on the Status of functional qualification of main steam safety and relief valves in the following way:

Since the identification of the Valves issue several years back, the detailed examinations and the actions taken up to the most recent Comprehensive Safety Case Revisit demonstrate a comprehensive process directed towards improvement. When considering the concerns expressed in the Austrian Technical Position Paper (ATTP) the comparison with the current status also indicates a number of areas of improvement.

The Czech presentation and the discussion indicated several positive activities within the frame of the Comprehensive Safety Case Revisit (CSCR); these appear to increase functional reliability of the main steam relief valves (BRU-A) and of Safety Valves (MSSV) in general. They relate to the replacement of electrical actuators of the BRU-A valves and of pilot valves of the MSSVs on both units.

The Czech operator's and TSO's approach to functionally qualify the main steam and relief valves for two-phase and water flow applying the ASME-QME-1994 similarity approach appears feasible only in case the related requirements are followed. Should compliance with requirements only be possible for specific steps in the qualification procedure, then situations of non-compliance should be compensated by performing well developed, adequate state of the art analyses, as e.g. in Germany.

Up to now, however, ASME-QME-1994 qualification requirements have only partly been met. Adequate analyses for compensation according the state of the art have not been demonstrated as having been performed.

In the opinion of the Austrian Experts' Team the Czech approach is therefore not yet sufficient to demonstrate that the main steam relief and safety valves are qualified for the dynamics of two-phase flow and pressurised sub-cooled water flow conditions. The basis on which the Regulatory Authority has accepted the above solutions did not become evident to the Austrian Experts' Team.

The Austrian Experts' Team therefore recommends the completion of the functional qualification of the main steam safety and relief valves by tests and by comprehensive analyses.

Based on the recognition that the pertinent Czech-Austrian Bilateral Agreement is the appropriate framework giving the opportunity for further discussion and sharing additional information on these issues, the Austrian Experts' Team would appreciate if the above major findings could be revisited in a further bilateral information exchange related to the Qualification of Valves.

Note that the assessment of technical adequacy is closely related to a number of other "Roadmap" items. Consequently, the final evaluation at the now ending Monitoring process on the technical level of the Item No. 2 "Qualification of Valves", as set out in the Roadmap, has taken into account also the results of other Roadmap events as well as additional information which was made available by the Czech side.

ZUSAMMENFASSUNG

Die Republik Österreich und die Tschechische Republik haben mit Unterstützung des Mitglieds der Kommission Verheugen am 29. November 2001 eine Übereinstimmung über die „Schlussfolgerungen des Melker Prozesses und das Follow-up" erzielt. Um eine wirksame Umsetzung der Ergebnisse des Melker Prozesses im Bereich der nuklearen Sicherheit zu ermöglichen, enthält der ANHANG I dieser „Vereinbarung von Brüssel" Details zu spezifischen Maßnahmen, die als Follow-up zum „Trialog" des Melker Prozesses im Rahmen des betreffenden bilateralen tschechisch-österreichischen Abkommens durchzuführen sind.

Weiters legte die Kommission zur Prüfung der Umweltverträglichkeit des KKWs Temelín, die auf Grund einer Resolution der Regierung der Tschechischen Republik eingesetzt wurde, einen Bericht vor und schlug in ihrer Stellungnahme die Umsetzung einundzwanzig konkreter Maßnahmen vor (ANHANG II der „Vereinbarung von Brüssel").

Zur Überwachung auf technischer Ebene im Rahmen des diesbezüglichen tschechisch-österreichischen bilateralen Abkommens wurde, wie in der „Vereinbarung von Brüssel " vorgesehen, eine “Roadmap“ („Fahrplan") ausgearbeitet und am 10. Dezember 2001 vom stellvertretenden Premierminister und Außenminister der Tschechischen Republik sowie vom Bundesminister für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft der Republik Österreich vereinbart.

Das österreichische Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft beauftragte das Umweltbundesamt mit der Gesamtkoordination der Umsetzung der “Roadmap“. Jeder Eintrag in der “Roadmap“ entspricht einem spezifischen technischen Projekt (siehe ANNEX IV). Für jedes Projekt wurde ein eigenes internationales Expertenteam mit der Durchführung der entsprechenden Arbeiten vom Umweltbundesamt beauftragt. Für das in Betracht stehende Projekt wurden das Institut für Risikoforschung an der Universität Wien und das Österreichische Forschungszentrum Seibersdorf als Leiter des Expertenteams ausgewählt.

Punkt Nr. 2 “Qualification of valves“ („Ventilqualifizierung") im ANHANG I der „Vereinbarung von Brüssel“ behandelt die funktionelle Qualifizierung der Frischdampf-Sicherheitsventile (MSSV oder SGSV) und der Frischdampf-Entlastungsventile (BRU-A) auf der 28,8 m – Bühne des Zwischengebäudes des KKW Temelín. Wie im ANHANG I der „Vereinbarung von Brüssel" aufgezeigt, lautet das unter diesem Punkt angeführte Ziel: *„Nachweis der zuverlässigen Funktionstüchtigkeit von Frischdampf-Sicherheits- und -Abblaseventilen unter dynamischer Belastung bei Durchströmen von Wasserdampfgemisch."*

Die "Roadmap“ sah für die zweite Hälfte des Jahres 2002 einen Spezialisten-Workshop in Prag zur Erörterung dieser Thematik vor.

Der Ansatz der tschechischen Seite

Ein wesentliches Ereignis im Überprüfungsprozess (“Monitoring Process“) war der gemeinsame Spezialisten-Workshop zu den Punkten Nr. 1 („HELB", (PN 2)) und Nr. 2 („Qualifizierung der Ventile“) der “Roadmap“, der am 7. und 8. November 2002 in Prag, im Rahmen eines zusätzlichen Spezialisten-Workshops, gemäß Artikel 7 (4), des Bilateralen Nuklearinformationsabkommens abgehalten wurde. Angesichts des Zusammenhanges zwischen den beiden Themenbereichen, hielten es die tschechischen Gastgeber für angebracht, beide Punkte in ein- und demselben Workshop zu behandeln. Die Auswertung der dort zur Verfügung gestellten Informationen dient im Wesentlichen als Grundlage für den vorliegenden Endgültigen Überprüfungsbericht (Final Monitoring Report) des Expertenteams.

Die Qualifizierung der Funktionstüchtigkeit der Frischdampf-Entlastungsventile und -Sicherheitsventile wurde im Zuge des Spezialisten-Workshop von der tschechischen Organisation zur technischen Unterstützung (Technical Support Organisation, TSO) und der Aufsichtsbehörde SÚJB im Rahmen der Information zur Integrität der Rohrleitungen als Teil des “Comprehensive Safety Case Revisit (CSCR)“ (siehe Projekt PN2) behandelt. Die Aufsichtsbehörde SÚJB hatte zunächst die Ergebnisse der Ventilqualifizierung vorläufig genehmigt. Auf Basis des Austausches einiger Komponenten und „neuer Berichte zur Qualifizierung" hat SÚJB die Ergebnisse des CSCR als Bestätigung und Ergänzung der ursprünglichen Entscheidung angesehen und abgenommen.

Seitens Aufsichtsbehörde und TSO wurden Informationen zu folgenden Bereichen gebracht und erörtert:

- Qualifizierung der Funktionstüchtigkeit der verwandten „Vorläufer“-Ventile (Parent Valves) in Bezug auf die Entlastungsventile (BRU-A) und Frischdampfsicherheitsventile (MSSV) für Wasser und Dampf-Wassergemisch
- Erweiterung der Qualifizierung der Funktionstüchtigkeit der verwandten „Vorläufer“-Ventile auf die zu prüfenden Temelín BRU-A Entlastungs- und Frischdampfsicherheitsventile gemäß ASME-QME-1-1994, QVC basierend auf der Ähnlichkeit der Ventile
- Qualifizierung des BRU-A – Auslösemechanismus für Umgebungsbedingungen
- Austausch der Vorsteuerventile für die Frischdampf-Sicherheitsventile (MSSV) und des elektrischen Antriebsmotors der BRU-A Entlastungsventile

Die Vorgangsweise der Betreibergesellschaft ČEZ zur Lösung des Sicherheitsproblemfalles „Qualifizierung der Frischdampfentlastungs- und -Sicherheitsventile" (wie von SÚJB approbiert) besteht in der Anwendung der ASME Code Prozedur ASME QME-1-1994, QVC. Diese Prozedur beruht auf der Ahnlichkeit von geprüften „Vorläufer“-Ventilen und den „zu prüfenden“ Ventilen. Der Prozedur entsprechend sind jene Ventile, die im KKW Temelín verwendet werden, als die „zu prüfenden" Ventile anzusehen. Ihre Qualifikation sollte durch die Erweiterung des Qualifizierungsprozesses von ähnlichen „Vorläufer"-Ventilen auf die „zu prüfenden" Ventile für Temelín erreicht werden. Diese „Vorläufer"-Ventile sollten bereits einen erfolgreichen Qualifizierungsprozess durchlaufen haben und von der selben Firma hergestellt worden sein. SÚJB hat die von ČEZ und der Organisation zur technischen Unterstützung (TSO) gewählte spezielle Vorgangsweise als eine Anwendung der genannten ASME Code Prozedur zur Qualifizierung für Wasser und Zweiphasenströmung (gleichzeitiges Auftreten von Dampf und Wasser) akzeptiert.

Die Workshop-Ausführungen gaben zwar Aufschluss über den verwendeten Ansatz des Betreibers, erlaubten jedoch auf Grund der überblicksartigen Darstellung nur einen begrenzten Einblick in die Ergebnisse und auf welche Art diese erzielt worden sind. Es blieben einige Fragen offen. In der Folge kamen beide Seiten überein, dass das betreffende bilaterale Abkommen zwischen Tschechien und Österreich den geeigneten Rahmen für weitere Diskussionen und Informationsaustausch zu diesen Themenbereichen darstelle.

Der Ansatz des österreichischen Expertenteams

Ein Expertenteam von 5 internationalen Experten wurde vom Umweltbundesamt (Federal Environment Agency) – im Auftrag der österreichischen Regierung – mit dem technischen Support zur Überwachung der Ventilqualifizierungs-Thematik auf technischer Ebene (wie im ANHANG I der Schlussfolgerungen des Melker Prozesses und des Follow-up vorgesehen) beauftragt. Dieses spezifische technische Projekt wird als Projekt PN3 bezeichnet, welches insgesamt sieben vorgegebene „Projektmeilensteine" (PM) umfasst.

Um den vorbereitenden Arbeiten des österreichischen Expertenteams eine Ausrichtung zu geben und die österreichische Delegation durch den Spezialisten-Workshop zu führen, aber auch um eine geeignete Vorbereitung des Spezialisten-Workshops auf bilateraler Ebene zu ermöglichen, wurde als **erster Schritt** (Projektmeilenstein 1 – PM1) das Sicherheitsziel in „Überprüfbare Teilaspekte" ("Verifiable Line Items" (VLIs) aufgegliedert (siehe ANNEX A). Diese wurden bereits auf Grundlage des ASME-Ähnlichkeitskonzeptes[2] erstellt, da der tschechische Ansatz aus vorangegangenen Diskursen im Prinzip bekannt war.

Im **zweiten Schritt** wurde vom Expertenteam eine Dokumentenliste (PM2) "Specific Information Request – SIR" erstellt, die eine Auflistung jener Informationen darstellt, die zur ausführlichen Beantwortung der in den VLIs enthaltenen Fragen erforderlich ist (siehe ANNEX C).

Zum **dritten Schritt** (PM3) der vorbereitenden Arbeiten für den Workshop gehörte auch eine Erhebung jener Standards und Praktiken, die innerhalb der EU-Mitgliedstaaten bezüglich der Ventilproblematik angewandt werden. Die Praxis in Deutschland stellte hier einen Schwerpunkt dar, weil dort besondere Anstrengungen zur Qualifikation von Ventilen unternommen wurden. Bei der Informationsveranstaltung für die österreichische Delegation (PM3) wurden den zu entsendenden Teilnehmern diese Elemente des "Monitoring" vorgestellt.

Im Rahmen des am 7. und 8. November 2002 in Prag abgehaltenen Workshops über HELB und Ventilqualifikation gaben Experten der Betreibergesellschaft der Anlage, Experten von Organisationen zur technischen Unterstützung (Technical Support Organisation, TSO) und Experten der Genehmigungsbehörde 15 gut aufbereitete Videoprojektor-Präsentationen, die nach tschechischer Aussage zusammengestellt wurden, um einen Überblick zu geben. Ein Vortrag davon war insbesondere der Qualifizierung der Ventile, dem PN 3-Fragenkomplex gewidmet. Bis auf einige Einschränkungen wurden die meisten Fragen des Expertenteams während des Workshops beantwortet.

Nach dem Workshop folgte als **vierter Schritt** (PM4) ein Rückblick auf den Spezialisten-Workshop und die Mitglieder des Expertenteams lieferten Beiträge für den "Preliminary Monitoring Report".

Die Beiträge der Mitglieder des Expertenteams sind in der Folge vom Technischen Projektmanagement zusammengefügt worden, um die technischen Grundlagen für den vorläufigen Monitoringbericht zu liefern (PMR, Project Milestone PM4). Diese technische Grundlage wurde bei einem internen Zusammentreffen des Österreichischen Expertenteams, am 8. und 9. Dezember 2002 in Wien, überprüft und abgestimmt.

[2] Wenn für zumindest zwei Armaturen unterschiedlicher Dimension aber aus der gleichen Baureihe (Ventile besitzen gleiche Konfiguration) ein Funktionsnachweis durch physikalische Versuche erbracht worden ist, dann kann eine Armatur - auch aus einer abgeleiteten Baureihe, jedoch grundsätzlich gleicher Konfiguration (die zu qualifizierende Armatur) - unter bestimmten Bedingungen, ohne die vorgesehenen physikalischen Versuche zu absolvieren, als für die Funktion qualifiziert angesehen werden.

Die Auswertungen im vorläufigen Monitoringbericht behandeln drei verschiedene Ebenen des Vorganges, indem sie Kommentare liefern zu:

- der Angemessenheit der aus den Vorträgen verfügbaren Informationen im Hinblick auf die Überwachungsaufgabestellung und
- der Angemessenheit der technischen Herangehensweise als solcher,
- und Aspekten, welche auf die Lösung der Sicherheitsaspekte ausgerichtet waren und in welcher Verbindung diese zu den Aspekten stehen, die in den Projekten PN2: „Hochenergetische Rohrleitungen auf der 28,8 m Bühne“ und PN4: „Qualifikation von sicherheitsrelevanten Komponenten“ behandelt werden.

Im **fünften Schritt** (PM5) präsentierte die Österreichische Seite der tschechischen Seite, anlässlich des jährlichen bilateralen Expertentreffens am 18. Dezember 2003, die wesentlichen Ergebnisse des vorläufigen Monitoringberichtes. Die Diskussion brachte keine neuen Erkenntnisse.

Der **sechste und letzte Schritt** (PM6) im Monitoring Vorgang für PN3 “Ventile-Qualifikation” ist die Erstellung des abschließenden Monitoringberichtes, der hiermit vorgestellt wird.

Ergebnis des Monitoringprozesses

Der Monitoringprozess hat bisher dazu beigetragen, einige der VLIs abzuklären. Auf der Grundlage der verfügbaren Information formuliert das Expertenteam seine Sicht zum Stand der Ventilqualifizierung folgendermaßen:

Seit vor einigen Jahren der Problemkreis um die Ventile erfasst wurde, wird in umfassender Weise auf Verbesserungen hingearbeitet. Die Arbeiten reichen von detaillierten Überprüfungen bis hin zu den jüngst im Zuge des durchgeführten "Comprehensive Safety Case Revisit" getroffenen Maßnahmen. Bezugnehmend auf die im Austrian Technical Position Paper (ATTP) festgehaltenen Bedenken ergibt der Vergleich mit dem heutigen Stand, dass in einigen Bereichen Verbesserungen erzielt worden sind.

Die tschechischen Vorträge und die Diskussion zeigten verschiedene positive Aktivitäten im Rahmen des "Comprehensive Safety Case Revisit" auf, welche die funktionale Zuverlässigkeit der Frischdampf-Entlastungsventile (BRU-A) und -Sicherheitsventile (MSSV) generell anheben dürften. Sie betreffen den Austausch der elektrischen Antriebsmotoren der BRU-A Enlastungsventile und den Austausch der Vorsteuerventile zu den Frischdampf-Sicherheitsventilen in beiden Reaktorblöcken.

Die Vorgangsweise des tschechischen Betreibers und des TSO bei der funktionellen Qualifizierung der Frischdampf-Sicherheits- und Entlastungsventile für Zweiphasen- und Wasserströmung nach dem ASME-QME-1994-Ähnlichkeitskonzept scheint machbar, sofern die entsprechenden Anforderungen erfüllt werden. Sollte die Erfüllung dieser Anforderungen nur für spezifische Schritte des Qualifizierungsverfahrens möglich sein, sollten jene Punkte, die nicht erfüllt sind, durch entsprechende Analysen nach dem Stand der Technik kompensiert werden, wie er u.a. in Deutschland anerkannt und ausgereift ist.

Die ASME-QME-1994 Qualifizierungsanforderungen sind bis dato jedoch nur teilweise erfüllt. Die Durchführung entsprechender Analysen zur Kompensierung gemäß dem Stand der Technik wurde nicht präsentiert.

Nach Einschätzung des Expertenteams reicht die tschechische Vorgangsweise somit derzeit nicht aus, um nachzuweisen, dass die Frischdampf-Sicherheits- und Entlastungsventile für dynamische Zweiphasenstömungen und unterkühltes Wasser unter Druck qualifiziert sind. Die Basis, anhand welcher die Aufsichtsbehörde die oben angeführten Lösungen akzeptiert hat, wurde für das österreichische Expertenteam nicht einsichtig.

Das Expertenteam empfiehlt daher die Vervollständigung der funktionellen Qualifizierung der Frischdampf-Sicherheitsventile sowie der Entlastungsventile durch Tests und durch umfassende Analysen.

Im Bewusstsein, dass das diesbezügliche Bilaterale Nuklearinformationsabkommen einen geeigneten Rahmen für weitere Diskussionen und zusätzlichen Informationsaustausch darstellt, wäre es zu begrüßen, die oben angeführten wesentlichen Erkenntnisse in diesem Rahmen zu erörtern.

Es wird festgehalten, dass die Einschätzung technischer Angemessenheit eng mit einer Anzahl anderer "Roadmap"- Punkte verbunden ist. Deshalb hat diese abschließende Beurteilung von Item No. 2 "Qualification of Valves" jetzt am Ende des Monitoring-Prozesses auf technischer Ebene, wie er in der "Roadmap" festgelegt wurde, die Ergebnisse anderer "Roadmap"-Ereignisse berücksichtigt, ebenso zusätzliche Informationen, die von tschechischer Seite zugänglich wurden.

TABLE OF CONTENS

1 INTRODUCTION

The Republic of Austria and the Czech Republic have, using the good offices of Commissioner Verheugen, reached an accord on the "Conclusions of the Melk Process and Follow-up" on 29 November 2001. In order to enable an effective use of the "Melk Process" achievements in the area of nuclear safety, the ANNEX I of this "Brussels Agreement" contains details on specific actions to be taken as a follow-up to the "trialogue" of the "Melk Process" in the framework of the pertinent Czech-Austrian Bilateral Agreement.

To enable an effective "trialogue" follow-up in the framework of pertinent Czech-Austrian Bilateral Agreement, a seven-item structure given in ANNEX I of the "Brussels Agreement" has been adopted. Individual items are linked to:

- Specific objectives set in the licensing case for NPP Temelín units
- Description of present status and future actions foreseen by the licensee and SÚJB respectively.

Each item under discussion was followed according to the work plan agreed at the Annual Meeting organised under the pertinent Czech-Austrian Bilateral Agreement.

Furthermore, the Commission on the Assessment of Environmental Impact of the Temelín NPP – set up on the basis of a resolution of the Government of the Czech Republic – presented a report and recommended in its Position the implementation of twenty-one concrete measures (ANNEX II of the "Brussels Agreement").

The signatories agreed that also the implementation of the said measures would be regularly monitored jointly by Czech and Austrian experts within the Czech-Austrian Bilateral Agreement.

A "Roadmap" regarding the monitoring on the technical level in the framework of the pertinent Czech-Austrian Bilateral Agreement as foreseen in the "Brussels Agreement" has been elaborated and agreed by the Deputy Prime Minister and Minister of Foreign Affairs of the Czech Republic and the Minister of Agriculture and Forestry, Environment and Water Management of the Republic of Austria on 10 December 2001.

This "Roadmap" is based on the following principles:

- *The implementation of activities enumerated in ANNEX I and II of the "Brussels Agreement" will be continued to ensure that comprehensive material is available for the monitoring activities set out below.*
- *Having in mind the peer review procedure foreseen by the EU to monitor the implementation of the recommendations of the AQG/WPNS Report on Nuclear Safety in the Context of Enlargement, the Czech and Austrian sides agree that this peer review should serve as another important tool to handle remaining nuclear safety issues.*
- *As a general rule the regular annual meetings according to Art. 7 (1) of the bilateral Agreement between the Government of Austria and the Government of the Czech Republic on Issues of Common Interest in the Field of Nuclear Safety and Radiation Protection will serve to monitor the implementation of those measures referred to in Chapter V of the Conclusions and to address questions regarding nuclear safety in general, in particular those issues which – according to Chapter IV of the Conclusions – have been found, due to the nature of the respective topics, suitable to be followed up in the framework of this Bilateral Agreement.*
- *In addition, specialists' workshops and topical meetings will take place, organised as additional meetings according to Art. 7 (4) of the bilateral Agreement between the Government of Austria and the Government of the Czech Republic on Issues of Common Interest in the Field of Nuclear Safety and Radiation Protection, as set out in the "Roadmap".*

The Federal Ministry of Agriculture, Forestry, Environment and Water Management entrusted the Umweltbundesamt with the general management of the implementation of the "Roadmap". Each entry to the "Roadmap" corresponds to a specific technical project.

Item No. 2 "Qualification of Valves" of ANNEX I of the "Brussels Agreement" covers the functional qualification for Two-Phase and Water-Flow of the main steam relief (BRU-A) and safety valves (MSSV or SGSV) at the +28,8 meter level of the intermediate building of the Temelín NPP. The objective regarding this item as stated in ANNEX I of the "Brussels Agreement" is the "Demonstration of reliable function of key steam safety and relief valves under dynamic load with mixed steam-water flow".

ANNEX I of the "Brussels Agreement" further supplied the "Present Status and Specific Actions Planned" as follows:

> *"Demonstration of reliable function of key steam safety and relief valves is included in original licensing case of Temelín unit No. 1. To solve the difference in opinions of experts with regard to this issue, the Regulatory Authority initiated revisit of the qualification documentation in order to re-evaluate validity of Temelín key steam safety valves qualification. The result of these efforts will be made available to the Regulatory Authority till the June 2002 for final decision. Depending on the result, schedule for implementation of additional safety measures may be included into the above-mentioned regulatory submittal. The signatories understand that additional safety measures for both units will be considered by Regulatory Authority and if needed included into the above – mentioned regulatory decision in order to meet the objective of this item."*

The issue under project PN3 "Valves' Qualification" is one of a number of issues foreseen for monitoring (see page 77) in the frame of the "Roadmap". It concerns the qualification for water and two-phase flow (transition from water to steam) of the main steam relief valves (BRU-A) and the main steam safety valves (MSSVs) to cope with accident conditions including water leakage in a steam generator from the primary to the secondary side of the reactor.

An Austrian Specialists' Team of five international experts was committed by the Federal Environmental Agency on behalf of the Austrian Government to give technical support for the monitoring on the technical level of the implementation of the Valves Issue as listed in ANNEX I of the Conclusions of the Melk Process and Follow-up. This specific technical project is referred to as project PN3 comprising altogether seven predefined "project milestones" (PM)

The "Roadmap" specified that a Specialists' Workshop would be held in Prague in the 2nd half of 2002 to discuss this issue.

The approach by the Czech side

The key element in the monitoring process was a Specialists' Workshop on the "Roadmap" item No. 1 "HELB" (PN2) and "Roadmap" item No. 2 "Qualification of valves" conducted in Prague on 7 and 8 November 2002 in the framework of an additional expert meeting according to Art. 7(4) of the Bilateral Agreement of the Exchange of Information on Nuclear Safety. In view of the interrelation of the two issues, the Czech hosts deemed it useful to treat both items in the same workshop. The analysis of the information made available there is the basis for the present Final Monitoring Report of the Specialists' Team.

The main steam relief and safety valves functional qualification was addressed by the Czech Technical Support Organisation and the Regulatory Authority SÚJB in their presentations at the Specialists' Workshop and in the framework of the information provided during the pipe integrity related presentations (see project PN2) within the broad scope of the "Comprehensive Safety Case Revisit" (CSCR). The Regulatory Authority SÚJB has accepted preliminarily

the results of the valves functional qualification and with some replacements and based on "new qualification files", the results are accepted as endorsing the original decisions of the regulatory authority.

Information about the following main areas was presented by the Czech TSO and the Regulator and briefly discussed at the Specialists' Workshop:

- Parent Valves: BRU-A and MSSV Functional Qualification for Water and Steam-Water Mixture
- Extension of the Functional Qualification of Parent Valves to Temelín Candidate BRU-A and MSS Valves applying the ASME-QME-1-1994, QVC similarity approach
- Environmental Qualification of BRU-A Actuator
- Replacement of MSSV Pilot Valves and of Electric Motor Drives of BRU-A Valves

No additional background documents have been made available to the Specialists' Team.

The approach the operator of Temelín the ČEZ a.s. has taken to resolve the safety issue, "Qualification of main steam relief and safety valves" (as approved by SÚJB) is to treat those valves used in the Temelín NPP as "candidate" valves and to qualify them by extension of the qualification procedure of similar "parent" valves, which had already successfully passed a functional qualification test and were designed by the same company. The TSO and SÚJB cite this extension as an application of the special ASME Code procedure ASME QME 1 1994, QVC used for the qualification for water and two-phase flow (steam and water at the same time).

The presentations identified the approach taken by the Czech operator, but as overviews they provided only limited insight into the results and how these were obtained. A number of questions posed by the Austrian Specialists' Team was considered by the Czech side to exceed the level of detail or the scope of the "Roadmap" Workshop activities. Consequently, both sides agreed that the pertinent Czech-Austrian Bilateral Agreement is the appropriate framework giving the opportunity for further discussion and sharing additional information on these issues.

The approach of the Austrian Specialists' Team

The technical support for the monitoring was organised under the joint technical project management of the Institute of Risk Research (IRR, Wolfgang Kromp, Emmerich Seidelberger) and the Austrian Research Centers Seibersdorf (ARCS, Geert Weimann).

To focus preparatory work of the Austrian Specialists' Team and to guide the Austrian Delegation through the Specialists' workshop, but also to enable proper preparation of the Specialists' Workshop on the bilateral level, in a **first step**, Project Milestone 1 (PM1), the safety objective was broken down to Verifiable Line Items (VLIs) (see ANNEX B). Their contents and formulation reflected the Czech approach already known to the Austrian Specialists' Team at the beginning of the project, namely to qualify Temelín MSSV and BRU-A relief valves (both identified as "candidate" valves) by applying the ASME similarity approach between "parent" and "candidate" valves. The VLIs three main areas of attention aimed to be:

- Temelín "parent" main steam safety (MSSV) and relief valves (BRU-A) functional test qualification under dynamic water and steam/water conditions,
- Requirements and extension of functional test qualification of "parent" valves to Temelín units 1 and 2 "candidate" valves and
- Documentation of requirements for functional valve qualification, all according to ASME-QME-1-1994 and other applicable codes.

In a **second step** the Austrian Specialists' Team prepared a list of documents (PM2), the Specific Information Request – SIR, considered to contain the kind of information required to provide profound answers to the VLIs (see ANNEX A) .

The **third step** in the preparatory work for the Workshop also included identification of standards and practices applied within the European Union Member States for the Valve Qualification issue to allow comparison with the Czech qualification approach. Special focus was placed on practices in Germany, because this EU Member State has devoted considerable resources to analyses of valves behaviour. In addition, practice in the US has been considered extensively, because the operator of ETE applied US-codes, rules and regulations. In the Briefing to the Austrian Delegation (PM3), these elements of the monitoring were presented to the mission participants.

The key element in the monitoring process was a Specialists' Workshop on the "Roadmap" item No. 1 "HELB" (project PN2) and "Roadmap" item No. 2 "Qualification of Valves" conducted in Prague on 7 and 8 November 2002 in the framework of an additional expert meeting according to Article 7(4) of the Bilateral Agreement of the Exchange of Information on Nuclear Safety. In view of the interrelation of the two issues, the Czech hosts deemed it useful to treat both items at the same workshop. The analysis of the information made available there is the basis for the present Final Monitoring Report of the Specialists' Team.

Given the scope and schedule of the project, the Austrian Specialists' Team focused on monitoring the results of the efforts of the Czech specialists, as presented at the Specialists´Workshop, by a plausibility check.

Electronic copies of the Czech presentations prepared for the Specialists' Workshop on HELB and Qualification of Valves (listed in ANNEX B) were made available a few days prior to the Specialists' Workshop.

At the Specialists' Workshop on HELB and Qualification of Valves in Prague on 7 and 8 November 2002, Czech experts from ČEZ a.s., the Nuclear Research Institute Řež plc, the Institute of Applied Mechanics Brno, Ltd., and from the SÚJB made fifteen well-prepared slide beamer presentations, one of which was particularly devoted to the Qualification of Valves PN3 issue, characterised by a Czech presenter as being of an overview nature. Following this presentation, time was provided for questions from the Specialists' Team. While some points in question were substantiated during the workshop, a number of questions was considered to exceed the level of detail or the scope of the "Roadmap" Workshop activities by the Czech side. Discussion on these questions was limited to side conversations. No additional background documents were supplied to the Austrian Specialists' Team at the workshop.

Following the Specialists' Workshop, in a **fourth step**, the Austrian Specialists' Team reviewed intensively the Czech presentations, viewgraphs and the answers to questions posed during the Specialists' Workshop. The contributions of the Austrian Specialists' Team members have been merged by the Technical Project Management to provide the technical basis for the Preliminary Monitoring Report (PMR, project milestone PM4). This technical basis was reviewed and commonly agreed in an internal workshop of the Austrian Specialists' Team held on 8-9 December 2002 in Vienna.

The evaluations in the PMR addressed three different levels of the process by commenting:

- on the adequacy of the information available in view of the monitoring task (i.e. the presentations) and
- on the adequacy of the technical approach as such
- on issues directed towards a resolution of the safety issue addressed and on its interrelation to the items of projects PN2: High Energy Pipe Lines at the 28,8 m Level and PN4: Qualification of Safety Classified Components

In a **fifth step** the Austrian side presented a summary of the preliminary monitoring report of the valves´issue and the related **main findings** at the Bilateral Meeting on December 18, 2003. The discussion with the Czech partner resulted in no information becoming available, which would have to be considered and would have added to the evaluation.

The **sixth and final step** in the monitoring process of PN3 “Valves´Qualification” was to set up the Final Monitoring Report (FMR), which is presented herewith.

2 ISSUE SPECIFICATION AND CZECH RESPONSE

In the VVER-1000 design adopted at Temelín, there are four main steam pipes (see Figure 1 and Figure 2). The steam pipes travel in pairs on opposite sides of the containment, through the containment wall, and take a number of bends until they reach the main steam isolation valves (MSIVs) in pairs on opposite sides of the front of the + 28,8 meter elevation of the reactor building.

Three piping loops are connected to each steam pipe with T-joints. These are referred to as "bubliks". The bubliks lead to the main steam relief valve (BRU-A, see Figure 3) and two bubliks lead each to one main steam safety valve (MSSVs, see Figure 4). Functional qualifications of these valves are in question here.

Regarding this issue, the Austrian Technical Position Paper [ATPP 2001] containing the Austrian conclusions at the end of the tripartite “Melk Process”, states:

> *For the main steam relief and safety valves the functional qualification is still pending. Non-qualified valves could remain stuck open in case of accident operation under two-phase flow conditions. This could trigger an event sequence resulting in a severe accident with large release of radioactivity. In addition, isolation valves on the main steam lines upstream of the relief valves, which could mitigate the adverse consequences of a stuck open valve, are not installed in Temelín.*

The AQG/WPNS report [WPNS 2001] also contained a recommendation on this issue:

> *The Czech Republic should report on progress in ... measures to complete the demonstration of reliable function of key steam safety and relief valves in Temelín 1-2 under dynamic load with mixed steam-water flow.*

Based on the Conclusions of the Melk Process and Follow-up, Annex 1 [Melk 2001]; AQG/WPNS country specific recommendation [WPNS 2001], the objective of the Project PN3 is as follows:

> *“Demonstration of reliable function of key steam safety and relief valves under dynamic load with mixed steam-water flow.”*

The State Office for Nuclear Safety initiated what it refers to as a “Comprehensive Safety Case Revisit” (CSCR) of the HELB issue by requesting ČEZ, a.s. to "produce safety documentation enabling the SÚJB to settle the discrepancy in opinions of experts on above mentioned issues in a way standard for regulatory practices – by reassessment of existing safety case taking into account newly available information and technical arguments" [WPNS 2001].

The bases for SÚJB approval of the qualification of the BRU-A and MSSVs at the initial licensing stage were as follows:

- Results of the Mochovce NPP “parent” main-steam relief valves tested at the French Cumulus facility are also applicable for the main-steam relief valves used for the NPP Temelín.
- The Mochovce parent main steam relief valves do not show any deviations from the valves used at the NPP Temelín with regard to their functional mode of operation and the materials used.
- Differences exist only in the geometrical dimensions (smaller diameter).
- With regard to the main steam safety valves, test results of a specific safety valve also apply to the main-steam safety valves used at the NPP Temelín, since they are reported to be both of identical design and are made by the same manufacturer.

At the time of the Temelín unit one start-up approval, the above-mentioned sequence of measures, when framed appropriately to the overall safety concept of the plant (as described in licensing documentation), was considered by the SÚJB as meeting the requirements of national legislation and IAEA recommendations. In addition, as far as the main-steam safety and relief valves are concerned, the SÚJB accepted their qualification with regard to loading with water as sufficiently demonstrated and clarified in line with the safety requirements.

As part of the WPNS initiated CSCR, SÚJB requested completion of the valve qualification file for the BRU A and the MSSVs for steam-water mixture performance and accepted the valves as qualified based on the following considerations:

- Design similarity requirements are followed according to the ASME Standard QME-1-1994 [ASME 1994], and confirmed with the manufacturer.
- Qualification of the BRU-A and MSSV two-phase and water flow has been demonstrated by meeting the requirements for “extension of qualification” from qualified parent valves.
- Environmental qualification for the BRU-A actuator was confirmed for normal operation over 30 years and a postulated design basis earthquake.

SÚJB accepted the above as demonstration of reliable function of the BRU-A and MSSVs under dynamic load with mixed steam-water flow, and concluded that the “qualification concept described as meeting national requirements and well developed international practice”. Notwithstanding this outcome, SÚJB requested the following additional measures:

- Replacement of electrical actuators of the BRU-A valves on both units.
- Replacement of pilot valves of the MSSVs on both units.

These two actions were based on evaluation of experience feedback data and regulatory surveillance results related to in-service inspection, maintenance and commissioning tests.

3 CZECH PRESENTATION ON VALVES FUNCTIONAL QUALIFICATION – EVALUATION BY THE AUSTRIAN SPECIALISTS' TEAM AND OPEN ISSUES

A representative of the Czech TSO gave an overview presentation of the valves functional qualification and its resolution at the Specialists' Workshop in Prague on 8 November 2002.

The Austrian Specialists' Team evaluation presented in this chapter and the issues identified as open refer to the presentation mentioned, the related discussion with the Czech specialists and the specific contributions of the representative of the regulator SÚJB at the Workshop.

In the following sub-chapter 3.1. a more general recollection by the Austrian Specialists' Team is reflected, while in 3.2 specific topics addressed by the Czech TSO are evaluated.

3.1 Overall evaluation of resolving issues

The Czech presentation and the discussion indicated several positive activities within the frame of the Comprehensive Safety Case Revisit (CSCR), which appear to increase functional reliability of the main steam relief valves (BRU-A) and of Safety Valves (MSSV) generally. They relate to the replacement of electrical actuators of the BRU-A valves and of pilot valves of the MSSVs on both units.

The influence of these measures on the functionality of the valves under dynamic water and two-phase conditions, however, became not evident.

3.2 Adequacy of the information received

There is a clear consensus amongst the Austrian Specialists' Team that the related presentation by CEZ and SÚJB was informative, but on a very general level. The Austrian Specialists' Team could not draw final conclusions based on documented evidence for the Monitoring process, since there was no insight provided, especially into the CSCR documents as submitted by ČEZ a.s. to the SÚJB, and the corresponding formal SÚJB decision on the CSCR.

3.3 Adequacy of the solutions presented

The Main Steam Safety and BRU-A relief valves' qualification procedures and the extension of their qualification to two-phase flow, according to the similarity principles, have not been presented as a consistent application of a set of rules accredited by an independent licensing authority. The integral approach to the issues involved was missing in the related presentations of the representatives of the TSO and the SÚJB.

The Austrian Specialists' Team could not identify conclusively from the available Workshop presentation by the TSO the consistency and completeness of use of codes, standards, rules and regulations applied. There is no evidence on how the gaps between the original design-code, standard, rules and regulations and those used for valves qualification and re-qualification have been bridged.

3.4 Evaluation of Specific Topics addressed in the Czech TSO Presentation

3.4.1 Water Hammer

Several water hammer load cases for transient and accident conditions are to be considered for the main steam and feed-water lines at the 28,8 m level (topic treated under PN2: "High Energy Pipe Lines at the 28,8 m level"). Opening and closing of one or both MSSVs and/or the BRU-A relief valve mounted on the main steam lines and the blow down of steam water mixture followed by water through these valves might represent such load cases, for example. It has to be demonstrated that the piping system as well as the related valves remain integer and functional according to specification under these load conditions.

- The functional qualification procedures the valves have undergone to demonstrate structural load bearing capabilities sufficient to survive water hammer loads have not been presented at the Specialists' Workshop. This holds true for both the "parent" and for the "candidate" valves.

3.4.2 Qualification of BRU-A and MSSV for Two-Phase Flow

- The ASME code procedure [ASME 1994] requires a minimum of two parent valves to pass the qualification.

  The Czech TSO and the Regulator SÚJB claim that the main steam relief valve (BRU-A) and the main steam safety valves (MSSV) are qualified by extension – demonstrating comparable properties of similar valves according to ASME Code QME 1-1994, QVC – from similar valves which had successfully passed the required qualification procedure and met all qualification requirements.

  In both the cases of the BRU-A and MSSV, however, only one parent valve was reported been used as the basis for extension to the valves present in Temelín. Therefore, the ASME Code QME-1-1994 code requirements appear not to been followed in the opinion the Specialists' Team. Arguments by the Czech TSO and/or by the Regulator related to this specific approach taken are lacking and would be welcome to the Experts' Team.

- The ASME code for valve testing requires a minimum of two tests for each type of flow to demonstrate qualification. In the case of the MSSV, as reported in the Czech TSO presentation, the parent valve was not tested for two-phase flow at all "…and only for cold water (< 100 °C) instead of pressurised sub-cooled water (about 300 °C)…".
- Thus, the Temelín candidate MSSV could not be considered by the Austrian Specialists' Team to be qualified for two-phase flow and pressurised sub-cooled water flow. Arguments by the Czech TSO and/or by the Regulator related to this specific approach taken are lacking and would be welcome to the Specialists' Team.
- The ASME code requires, beside other defined test conditions, that tests have to be planned. The parent BRU-A was actuated at one occasion, which seems to have been a spurious event rather, than a test under planned conditions for two-phase flow, because two-phase flow conditions developed quite unexpectedly, as reported by the TSO at the Workshop. Inasmuch as there is only a single and unplanned two-phase flow test of the parent BRU-A valve, the Temelín candidate BRU-A valve cannot be considered to be qualified for two-phase flow.

- The ASME code clearly calls for similarity between parent and candidate valves as one of the prime conditions. The ASME code does not permit such an extension from one type of valve to another type of valve.

  In this context, when shown the evidence that the MSSV tests did not include two-phase flow (see APPENDIX II), the Czech TSO responded that for the BRU-A (not the MSSV), the two-phase loads were less than the water or steam loads, and that it was assumed that the same would hold true for the MSSV. (The BRU-A valve is a motor-actuated valve, whereas the MSSV uses a pilot valve for actuation. The valves are completely different in form and function — indeed, quite deliberately so for reasons of diversity.)

  Thus, the MSSV candidate valve qualification for two-phase flow cannot be related to the BRU-A parent valve test. Such a justification is not permitted under ASME code requirements, and no independent basis for accepting such a procedure was cited by the Czech TSO.

  In fact, the ASME code requirements were apparently not followed. The Austrian Specialists' Team considers neither valve to be qualified for two-phase flow and, in the case of the MSSV, not be qualified for pressurized subcooled water flow either. AQG/WPNS recommended precisely the qualification for two-phase flow [WPNS 2001].

  The Czech TSO has not demonstrated at the Specialists' Workshop that this recommendation has been fulfilled.

- It must be noted that in German practice for PWRs in operation in Germany, main steam relief and safety valves were tested in general at full scale in an experimental qualification program.

  The reported Czech approach did not yet consider fullscale test functional qualification for the Temelín valves.

- Similarity demonstration by tests is not the only method allowed in the context of valve qualification. QVP-7200 of ASME code [ASME 1994] states that analytical methods are allowed as well. In the context of the present case, this means comprehensive analyses using well-tested and verified computer codes. Such analyses may replace some tests and may be used for the extension. This is common European practice. The results of the analyses by the computer code must compare well with all test results (verification of the code). These codes allow the missing tests to be simulated; they must also be used to extensively check the load cases in the real plant (where the candidate valve is installed).

  The Czech TSO specialists at the Workshop provided no confirmation if and to what extent such an analysis approach has been taken for Temelín valves qualification. Although the TSO presenter mentioned the Siemens analysis program SUPERVE, concerning MSSV no additional information about any computer analyses on the hydraulic and fluid dynamic functions was presented.

- Analytical verification of tests in order to quantify the valves' characteristics was not presented.

  Analytical extrapolations from model tests of valves and analyses of the NPP systems (candidate valves, boundary condition influences, number and type of calculated load cases) were not specified, although some calculations had apparently been done. These calculations should also have included verification of full capacity loads.

- Information about the environmental qualification of the BRU-A actuator was presented by the Czech TSO which was beyond the scope of PN3 but in the scope of PN4: "Qualification of safety classified components". Thus, the Austrian Specialists' Team performed no evaluation on this topic in the frame of PN3.

3.4.3 Comprehensive Safety Case Revisit (SÚJB Position)

The presentation during the Specialists' Workshop provided only limited information on the interaction between the licensee, the regulatory authority and the management of the safety issues by SÚJB in regulating the safety of Temelín NPP. There was little evidence on the position of the licensing authority regarding the permissible procedures on the qualification extension.

The reasoning and the position of the Safety Authority SÚJB therefore remained unclear to the Specialists' Team.

4 EVALUATION OF THE MONITORING PROCESS ACCORDING TO VLIs

This chapter summarises evaluation by the Austrian Specialists' Team (in chapter 3) according to the Verifiable Line Items (see ANNEX A), which have been verified by the Team in the frame of this project. In providing information on the extent to which these Line Items have been addressed by the Czech presentations at the Specialists' Workshop, it also indicates remaining issues and follow-up actions required for satisfactory monitoring (see also chapter "Conclusion") and for resolution of the issue related to the functional qualification of valves.

VERIFIABLE LINE ITEMs – the Austrian Specialists' Team's view
1. Evaluation of MSSV and BRU-A parent valves functional test qualification under dynamic water and steam/two-phase and steam-water conditions and comparison with ASME-QME requirements [ASME 1994]
The VLI was addressed at the Workshop. The related Czech information provided was an overview. Based on this information the MSSV and BRU-A parent valves appear to be of limited compliance and to some extent even in non-compliance with ASME-requirements. A full compliance check is recommended for MSSV and BRU-A parent valves functional test qualification on the basis of ASME-QME requirements. An adequate extension is recommended for partial or non-compliance situations.
2. Comparison of the MSSV and BRU-A parent valves with Temelín candidate valves and evaluation of extension of functional test qualification of parent valves to Temelín candidate valves
The VLI was addressed at the Workshop. Based on the rough Czech information provided, the Austrian Specialists' Team was unable to follow the actual steps taken by the Czech side in functional test qualification of parent valves and extension to the Temelín candidate valves according to ASME code requirements. Based on the outcome of VLI 1, the extension of functional test qualification of parent valves to Temelín candidate valves appears not to be in compliance with ASME requirements and thus the valves appear not to be functionally qualified. A comprehensive check on the feasibility of extending the functional qualification from the parent to candidate valves according ASME is recommended and an adequate substitution for partial or non-extendable situations is proposed.
3. Comparison of the functional qualification documentation of the Temelín MSSV and BRU-A candidate valves and evaluation of its compliance with ASME-QME requirements
The VLI was addressed at the Workshop. Due to lacking evidence the Austrian Specialists' Team was unable to prove fulfilment of documentation requirements according to ASME. It would be desirable to see evidence of qualification documents and to have insight into the set of these.
4. Verification of requirements for design, performance and testing/functional qualification of main steam safety and relief valves based on valves similarity: General practices, codes and regulations, and regulatory requirements in the European Union (focus: Germany) and USA
The VLI was implicitly addressed at the Workshop. The Czech approach taken for functional qualification of the Temelín MSSV and BRU-A valves appears not to be in compliance with the US ASME requirements and with European state-of-the-art practices.

5 CONCLUSIONS

The Monitoring process helped to clarify a number of VLIs. Based on the information currently available, the Austrian Specialists' Team formulates its view on the status of functional qualification of main steam safety and relief valves in the following way:

The Czech operator's and TSO's approach to functionally qualify the main steam and relief valves for two-phase and water flow applying the ASME-QME-1994 similarity approach appears feasible if the related requirements are followed. In case compliance with requirements could be reached only for specific steps in the qualification procedure, then adequate state of the art analyses should be performed to compensate for the non-compliance items. Such procedures are well developed in the EU (Germany).

The Austrian Specialists' Team directs the attention to two major open issues:

Up to now, however, ASME-QME-1994 qualification requirements have only partly been met. Adequate analyses for compensation according the state of the art have not been demonstrated as having been performed.

In the opinion of the Austrian Experts' Team the Czech approach is therefore not yet sufficient to demonstrate that the main steam relief and safety valves are qualified for the dynamics of two-phase flow and pressurised sub-cooled water flow conditions. The basis on which the Regulatory Authority has accepted the above solutions did not become evident to the Austrian Experts' Team.

Neither the main steam relief valve (BRU-A) nor the main steam safety valves (MSSV) can be considered therefore functionally qualified for two-phase flow, as recommended by the AQG/WPNS [WPNS 2001].

The Austrian Experts' Team therefore recommends the completion of the functional qualification of the main steam safety and relief valves by tests and by comprehensive analyses.

The tests should be performed for the actual Temelín valves (together with the new actuator in the case of the BRU-A and the new pilot valve in the case of the MSSV), because otherwise two parent valves for each type of valves will have to be tested for compliance with ASME code requirements. The test conditions should, to the extent possible, represent actual plant conditions under which the "candidate" valves should be operable. (Test for water flow at a temperature of about 300ºC, as encountered with large primary to secondary leaks, instead of 100 °C as was done in the test of the MSSV "parent" valve – see APPENDIX II).

The Austrian Specialists' Team would highly appreciate to be informed on efforts to this end. In particular the Austrian Specialists' Team would be interested in:

- A list of the qualification reports, including list of contents
- A list of all tests performed, listing each test with characterisation
- A list of all computer analyses, listing each analysis with characterisation.

Of course, access to representative documentation would be of considerable added value.

6 LIST OF REFERENCES

ASME 1994 ASME QME-1-1994, American Society of Mechanical Engineers, Qualification of Active Mechanical Equipment Used in Nuclear Power Plants, 1994

ATPP 2001 Austrian Technical Position Paper, http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/kernenergie/temelin/Melk/Trialog/positionpaper/etetrialogreport_gesamt.pdf.

Melk 2001 Conclusions of the Melk Process ad Follow-up, ANNEX 1, Brussels, 29.11.2001

PMR-PN2 Institute of Risk Research – Austrian Research Centers Seibersdorf, Vienna, Austria

WPNS 2001 http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/kernenergie/temelin/Melk/WPNS/wpns_report.pdf.

http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/kernenergie/temelin/Melk/WPNS/wpns_appendix.pdf.

http://www.umweltbundesamt.at/fileadmin/site/umweltthemen/kernenergie/temelin/Melk/WPNS/wpns_corrigendum.pdf.

SWS 2002 Specialists' Workshop Presentation (see ANNEX B) made by the Czech Representatives of the TSO and the regulator, Prague, November 7th and 8th, 2002

FIGURES

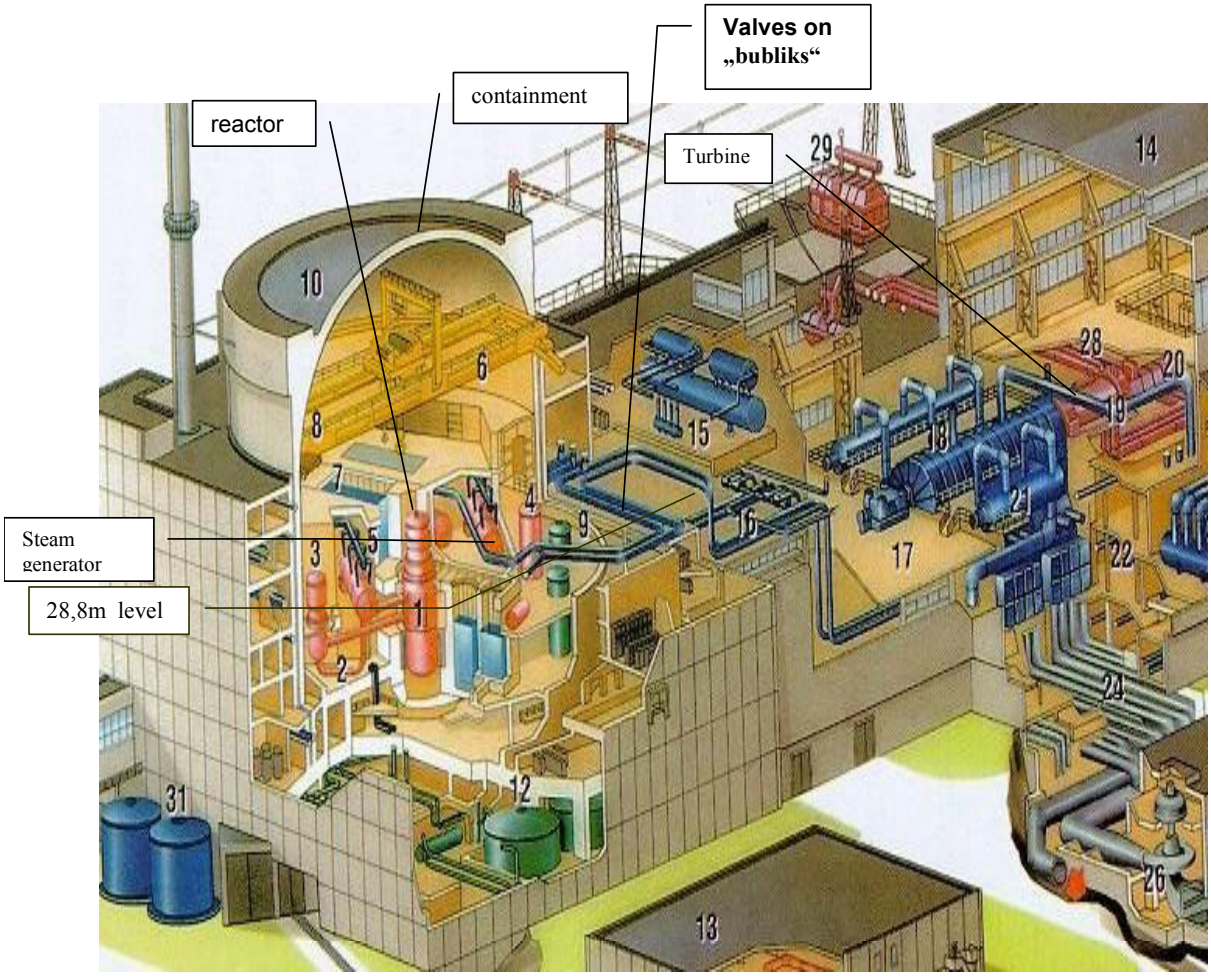
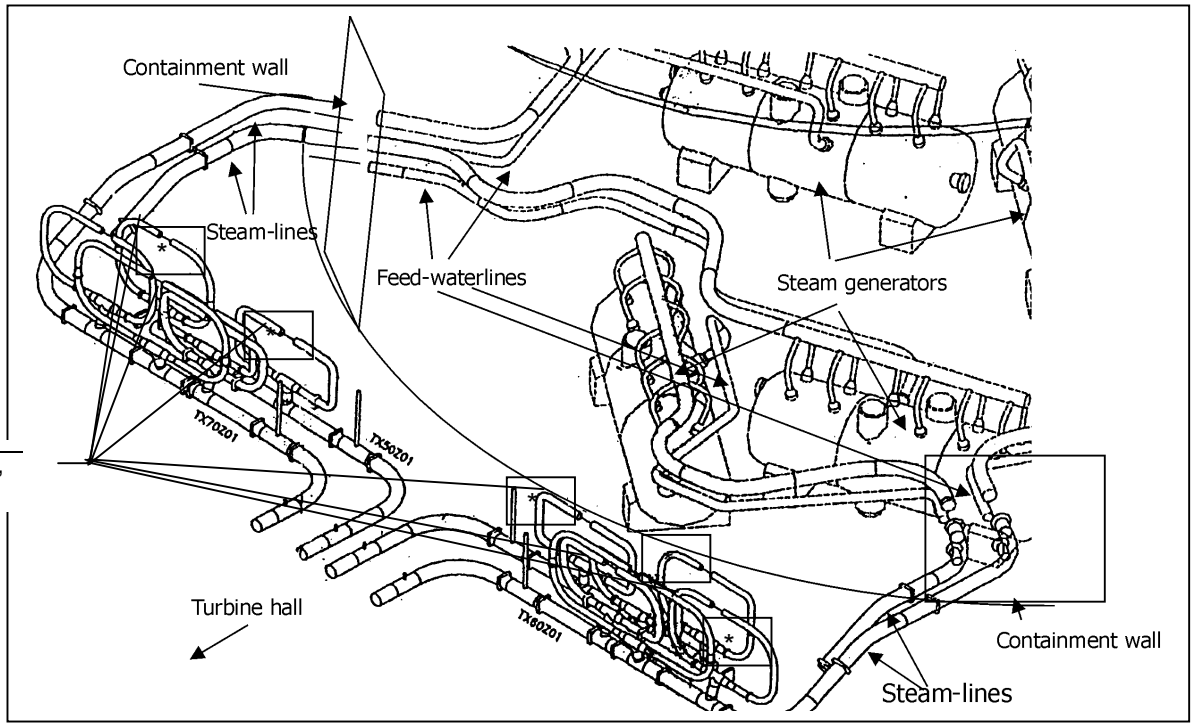


Figure 1: WWER-1000 NPP mock-up in between other exhibiting the 28,8 m level area and two main secondary feed water lines



3 “bubliks”

Figure 2: WWER-1000 main steam and feed water lines inside and outside the containment (at 28,8 m level)

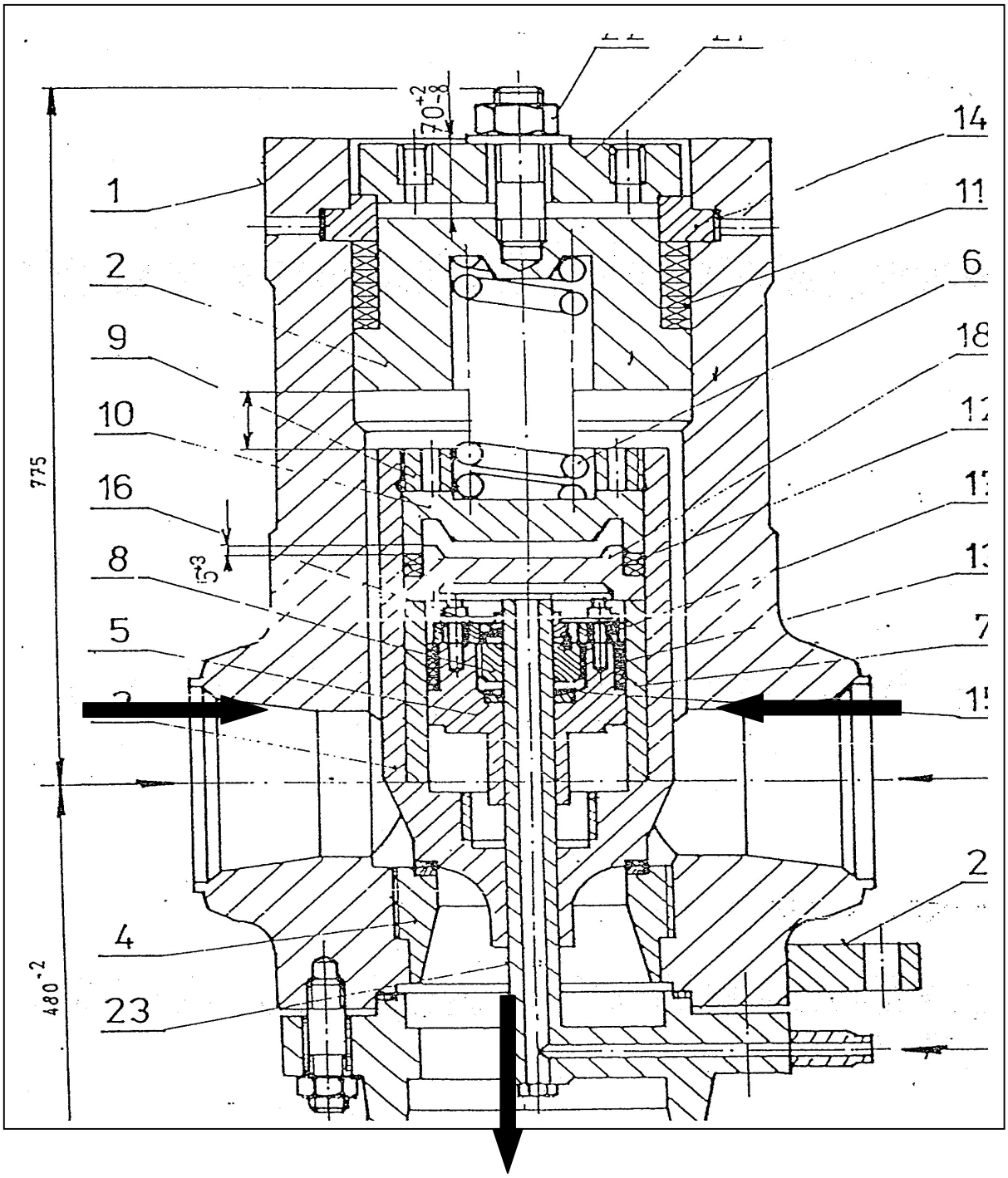


Figure 3: BRU-A Valve type Chekhov Type 1115-300/350 (WWER-1000)

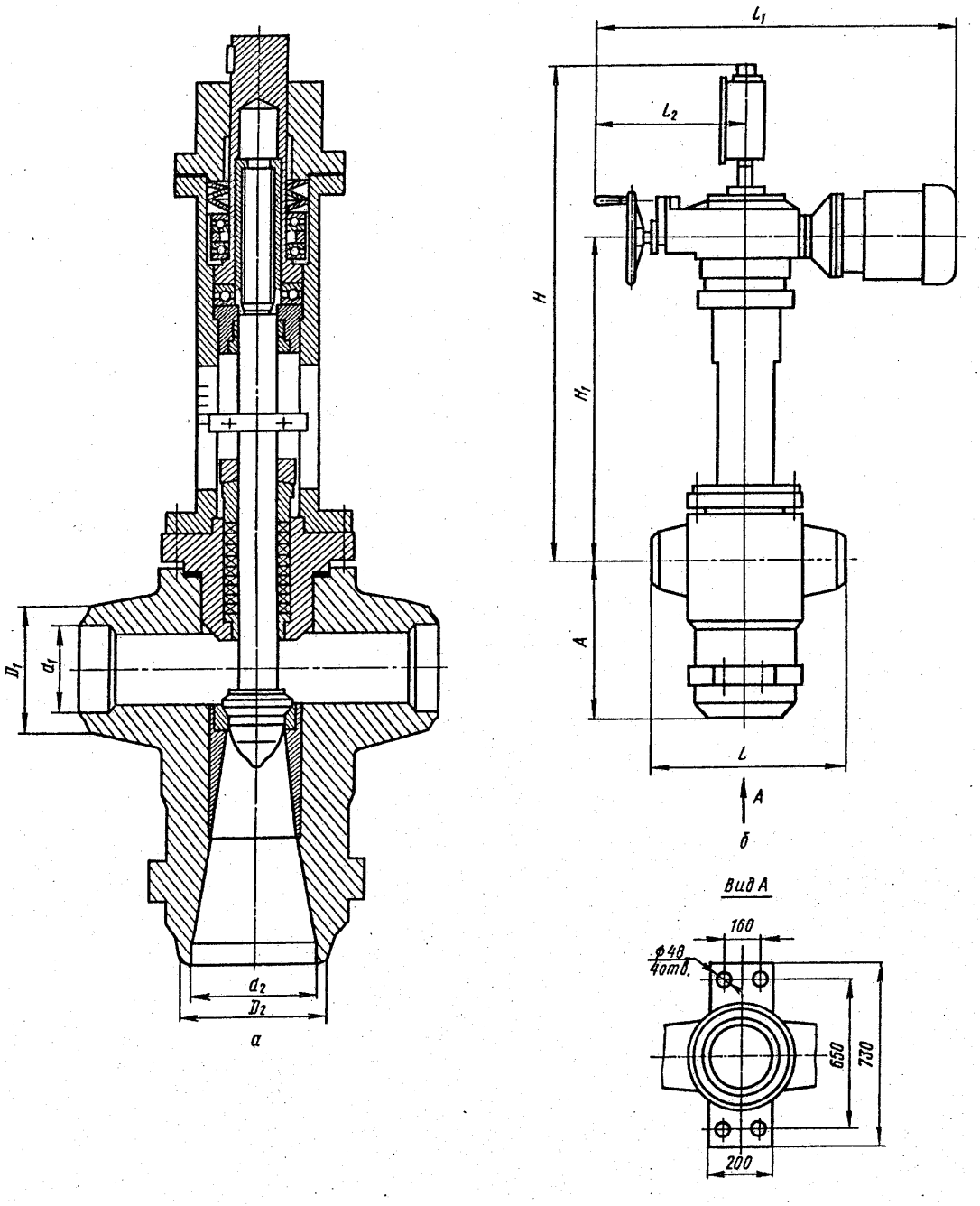


Figure 4: MSSV Valve type Chekhov Type 969-250/300 (ETE)

ABBREVIATIONS

Symbols	
[°C]	Temperature in degrees centigrade
MPa	Pressure in Mega Pascal
A	
A820 and 826/1	28,8 m level
APP	Application
AQG/WPNS	Atomic Question Group/Working Party on Nuclear Safety
ARCS	Consultant: Austrian Research Centers seibersdorf research
ASME	American Society of Mechanical Engineers
ASME Code QME	American Society of Mechanical Engineers Code for Qualification of Active Mechanical Equipment Used in Nuclear Power Plants
ASME QME-1-1994	American Society of Mechanical Engineers, Qualification of Active Mechanical Equipment Used in Nuclear Power Plants, 1994
B	
BRU-A	secondary system relief valves
C	
CERVUS	Working Group CERVUS
ČEZ	České energetické závody – the Czech Electricity Generating Company
ČEZ a.s.	Energetická společnost ČEZ, as
ČEZ/ETE	Nuclearna Electrarna Temelín
Chekhov	Checkov Company (joint venture with Siemens) producer of valves
Code	consistent package of rules and regulations
Code-Case	Individually treated application of a Code setting requirements
Commissioning	Licensing Process
CONF	Czech Conference Paper Series (documentation)
CSCR	Comprehensive Safety Case Revisit
CUMULUS	valves test facility of EdF
ČZ	Czech Republic
D	
DITI	Publication Series source not identifiable
diversity	identical function provided by applying different means
Doket	Document
E	
EC	European Community
E-C	Erosion-Corrosion
EdF	Électricité de France
ENIQ	European Network for Inspection Qualification
EQ	Environmental Qualification

Symbols	
E	
ETE	Electrarna Temelín NPP
ETE1	Electrarna Temelín NPP Unit 1
ETE2	Electrarna Temelín NPP Unit 2
EU	European Union
F	
FMR	Final Monitoring Report
FW	feed-water
G	
Guidelines	Non-mandatory recommendations for an identified purpose
H	
Harmonisation	develop a coherent view or solution
HEL	High Energy Lines
HELB	High Energy Line Break
I	
IAEA	International Atomic Energy Agency
IPU	SG Safety Valves (IPU-Valves)
IRR	Consultant: Institute for Risk Research
Isometric	drawing projection method for engineering designs
J	
JETE	Jaderna Electrarne Temelín
L	
LBP	Low Break Probability Concept of SKI (Sweden)
LBB	Leak Before Break Concept
Ltd	Limited
M	
Melk	City in Austria where the A – CZ "Melk Agreement" was signed
MFW	Main Feed-Water
MFWL	Main Feed-Water Line
Mochovce	EMO Nuclearna Electrarna Mochovce in Slovakia
MONITORING	Austrian oversight process along the Temelín "Roadmap" (see page 77)
MS	Main Steam
MSIV	Main Steam Isolation Valve separating the steam generator from the turbine
MSL	Main Steam Line
MSS	Main Steam System
MSSV	Main Steam Safety Valve
N	
NPP	Nuclear Power Plant
NRI-Řež	Nuclear Research Institute in Řež

Symbols	
P	
PM	Project Milestone
PMR	Preliminary Monitoring Report
PN2	Project Number 2 “High Energy Pipe Lines at the 28.8 m Level”
PN3	Project Number 3 “Qualification of Valves”
PN….	Project of the “Roadmap” (see page 77 ff.)□
PRISE	Primary to Secondary Leak Event
Procedure	Qualified and approved sequence of actions serving a specified purpose
Project Milestone	subdivision of IRR/ARCS Project
PTS	Pressurised Thermal Shock (quenching shock of structures under high pressure and temperature)
PWR	Pressurised Water Reactor
Q	
QME	Quality of active Mechanical Equipment
QVC	Extension of Qualification from Parent to Candidate Valves
QVP	Qualification for Parent Valves
R	
RANKING	Importance of document requested
redundancies	system portions providing for independent identical functions
S	
SAMG	Severe Accident Management Guideline
SG	Steam Generator
SGSV	Steam Generator Safety Valve
Similarity	Comparable operation properties of two components different in size
SIR	Specific Information Request
SKI	Swedish Institute
SRP	Standard Review Plan of the US-NRC
Specialists	Experts Appointed for the “Roadmap” Process
SÚJB	Státní Úřad Pro Jadernou Bezpečnost – Czech Licensing and Supervisory Body
SUPERPIPE	Indigenous "Safety Case” demonstration composed by the Czech partners
SUPERVE	Siemens program for valves’analysis
Surveillance	Properties development verification process
SV	Safety Valve
T	
TH	Thermal-Hydraulic
TOR	Terms of Reference
TSO	Technical Support Organisation
two-phase flow	Flow of a fluid consisting of two phases (e.g. steam and water)

Symbols	
U	
ÚJV	Ústav jaderného výzkumu Řež (ÚJV), Research Institute Řež
US	United States
USA	United States of America
US-NRC	United States Nuclear Regulatory Commission
UT	Ultrasonic Testing
UT NDE	Ultrasonic Testing Non Destructive Evaluation
V	
validated	Qualified for use in a validation procedure
VLI	Verifiable Line Item
VVER	WWER synonym (Water-cooled Water-moderated Energetic Reactor = VVER is an acronym for Vodo-Vodyannoy Energeticheskiy Reactor
W	
WORKSHOP	PM3 event in Prague
WPNS	Working Party on Nuclear Safety of the EU
WWER	PWR as the former East-Block Version

ANNEX A

VERIFIABLE LINE ITEMS

(Update 1 2002 09 13)

PN3 – PM1 (update1 2002 09 13) VERIFIABLE LINE ITEMS

VERIFIABLE LINE ITEMS	
1	Evaluation of MSSV and BRU-A parent valves functional test qualification under dynamic water and steam/two-phase and steam-water conditions and comparison with ASME-QME requirements [ASME 1994]
2	Comparison of the MSSV and BRU-A parent valves with Temelín candidate valves and evaluation of extension of functional test qualification of parent valves to Temelín candidate valves.
3	Comparison of the functional qualification documentation of the Temelín MSSV and BRU-A candidate valves and evaluation of its compliance with ASME-QME requirements
4	Verification of requirements for design, performance and testing/functional qualification of main steam safety and relief valves based on valves similarity: General practices, codes and regulations, and regulatory requirements in the European Union (focus: Germany) and USA

ANNEX B

WORKSHOP

Programme on High Energy Piping at 28,8 m

Level Revision 1, issued 2002 11 07

Workshop Programme on High Energy Piping at 28,8 m Level Date: 7-8 November, 2002 Place: SÚJB Prague

Thursday November 7, 2002				
	Workshop opening.	Krs (SÚJB)	-----	
1.	Temelín NPP position on high energy piping at 28,8 m level	Holán (ETE)	7.1	
2.	Comprehensive safety case overview.	Žďárek (NRI)	7.2.1	
3.	Dynamic calculations results due to the steam water hammer and water overfill overview.	Pečínka (NRI)	7.2.2	
4.	Flow accelerated corrosion assessment.	Pečínka (NRI)	7.2.3	
	Coffee Break (11^{15}-11^{45})		-----	
5.	PTS methodology/harmonisation with EU practice.	Pištora (NRI)	7.2.4	
	Lunch Break (12^{45} – 14^{00})		-----	
6.	Material Database Summary.	Ondrouch	7.2.5	
7.	**Qualification Dossiers for S-W Mixture of BRU-A and SGSV including EQ of BRU-A actuator.**	**Fridrich (NRI)**	**7.2.6**	
	Coffee Break (15^{00}-15^{30})		-----	
8.	Qualification of UT NDE	Horáček (NRI)	7.2.7	
9.	Displacement measurement results.	Junek (ÚAM)	7.2.8	
10.	Pipe break probability calculation overview	Pečínka (NRI)	7.2.9	
Friday November 8, 2002				
1.	UT NDE testing and results	Horáček (NRI)	7.2.7	
2.	Summary of TH analysis.	Macek (NRI)	7.2.10	
3.	Superpipe concept application on steam and feed water lines	Žďárek (NRI)	7.2.1	
	Coffee Break (10^{30}-11^{00})		-----	
4.	Time schedule and modifications required for 100% UT NDE.	Holan (ETE)	7.2.7	
5.	SÚJB preliminary assessment of the Safety Case results.	Krs (SÚJB)	7.1	
Lunch Break (12^{00} – 13^{30})				
	Discussion on Safety Case Status (13^{30} – open end)	Included in comments	----------	

ANNEX C

SPECIFIC INFORMATION REQUEST

Revision 4, issued 2002 11 27

Specific Information Request (SIR) **in the context of** " Item No. 2 Qualification of Valves (AQG/WPNS country specific recommendation)" Information about the use of the following tables: The SIR asks for documentation and information about all Activities undertaken to resolve the "Safety Case", which are treated in the Comprehensive Safety Case Revisit (CSCR). These **Activities are denoted** in the "6th Additional Information to the Decision Paper on Chapter 14 "Energy" " (Document. CONF-CZ-50/01, Brussels, 2001 09 17, **hereinafter in the APPENDIX I document**). It contains only aspects linked to the HELB issue that need to be treated (according to Conf-CZ 50/01).

The Activities have been numbered individually in columns 1 and 2 of the Table in APPENDIX I (page 66). The **requested Specific Information** (see the following table) is organised according to areas of interest for monitoring. In column 7 on page 59 it indicates the Activities the document is thought to be related to. The **WORKSHOP** has indicated some of the **documentation** available and these titles have been added* and the Activities they are associated with in column 7 (on page 63). Since most of the documentation is known neither by exact title and author, nor by document number or identification code, the expected content is outlined in the following tables by an English short title, indicating the main topic(s) of interest. Based on this information, the organisational technology units at CEZ/ETE, the supplier(s) and/or the licensing authority should be able to identify the relevant documentation.

Information contained in the documentation would be needed as one supplement to create answers to the Verifiable Line Items. A positive answer to the Verifiable Line Items supports assumptions about an adequate and consistent implementation of the ASME similarity approach for functional qualification of BRU-A relief and main steam safety valves . The Ranking I to III (introduced in column 2, 3, 4) of the SIRs applied in the following tables is only intended to indicate priorities for access to the related information. It does not indicate that some of this information would be less supportive to the monitoring process. *) It would be paticularly beneficial if key documentation as it is cited in the individual WORKSHOP presentations would be available in the MONITORING Process under way.

AREA	I	II	III	No	Qualification of Valves - Specific Information Requested	Reference APPENDIX I.
1	2	3	4	5	6	7
Scaling Feasibility	x			1	Report demonstrating the applicability of the ASME Parent Candidate Valve Qualification procedure to valves otherwise not designed or qualified according to ASME Code requirements [ASME 1994]	7.
	x			2	Report describing the effect of valve characteristics and parameters and their scaling (flow areas and throttles within the valve, resistance, friction, masses, fitting tolerances) on the valve characteristics for the Temelín units 1 and 2 main steam safety and relief valves (MSSV and BRU-A)	7.
Parent Valves Function	x			3	Report describing the functionality of the parent valves of Temelín units 1 and 2 main steam safety and relief valves (MSSV and BRU-A), including specific and detailed information about:	7.
	x				Specification of all load cases postulated for the pipe systems connected to parent valves	7.
	x				• Specification of the parent valves' functions with respect to the load cases	7.
	x				• Environmental and fluid conditions (pressure, temperature, acceleration)	7.
	x				• Opening and closing conditions (pressure and state of fluid (steam, two-phase, water))	7.

AREA	I	II	III	No	Qualification of Valves - Specific Information Requested	Reference APPENDIX I.
Parent Valves Function	x				• Limits for (total) opening and closing times	7.
	x				• Valve characteristics	7.
	x				• Specified mass flows for gas, liquid, and two-phase flow	7.
	x				• Method of operation and description of internal components (pilot valves, actuator, redundancies of pilot valves, filling or emptying valve chambers, …)	7.
	x				• Valves' internal flow scheme (see as an example fig. 1 and 2 in appendix)	7.
Parent Valve tests	x			4	Test report of the parent valves of Temelín units 1 and 2: main steam safety and main steam relief valves (MSSV and BRU-A) including specific and detailed information about:	7.
	x				• Function, functional sequences tested.	7.
	X				• Description of test environment (facility, geometry of pipes, fluid conditions (pressures, temperatures, mass flows))	7.
	x				• Description of the test (load) cases, test conditions realisation and conduct of tests	7.
	x				• Test results (time histories measured: stem position, pressures up and downstream, pressure and temperature in test-pressurizer and pipe if available, pressures in valve chambers)	7.
	x				• Description of results deviations from specification.	7.
Design and layout	x			5	Manufacturing drawings of the Temelín units 1 and 2 MSSV and BRU-A parent valves (i.e. Siemens-Chekhov MSSV and Mochovce BRU-A relief valve) including dimensions and tolerances for flow areas	7.
	x			6	Manufacturing drawings of the control valves of the Temelín units 1 and 2 MSSV and BRU-A parent valves (pilot valve?, pulse valve?, for actuation by pressure, …) including dimensions and tolerances for flow areas	7.
	x			7	Isometric drawings of the Temelín units 1 and 2 MSSV and BRU-A relief valve test-facilities piping system used in the functional test qualification for the parent valves (i.e. Siemens-Chekhov test facility for the MSSV parent valve and CUMULUS test facility for the BRU-A parent valve)	7.
Comparison Parent-Candidate Valves	x			8	Extension report containing all differences between MSSV and BRU-A parent and candidate valves of Temelín units 1 and 2 including	7.
	x			9	• Specification of all load cases to be postulated for the pipe systems involved for candidate valves	7.
	x			10	• Specification of the function of the candidate valves with respect to the load cases	7.

AREA	I	II	III	No	Qualification of Valves - Specific Information Requested	Reference APPENDIX I.
Transfer of Parent valve Results to Candidate valve	x			11	Report(s) on analyses to transfer results from the MSSV and BRU-A parent valves to the candidate valves of Temelín units 1 and 2	7.
	x			12	Report on the transfer of fluid and environmental conditions from the MSSV and BRU□A parent valves to the candidate valves of Temelín units 1 and 2 including detailed proof that no special tests are required for two-phase flow and a detailed description of MSSV tests for two-phase flow and water flow, problems encountered (e.g. valve chatter)	7.
	x			13	Isometric drawings of the pipes leading to and from all of the valves on the +28,8 m level of Temelín units 1 and 2	7.
	x			14	Manufacturing drawing of both valves (Main Steam Safety and Relief Valves, Temelín units 1 and 2), including dimensions and tolerances for flow areas	7.
Documentation Compliance	x			14	Compliance demonstration report about the approach, results and documentation of Temelín units 1 and 2 MSSV and BRU-A relief valves functional qualification with ASME-QME requirements, supported by a detailed description of Mochovce BRU-A tests (taking into consideration the requirements of ASME QME-1-1994, in particular section QVP-7320.3)	7.
Commissioning	x			15	Commissioning report on functional testing of MSSVs and BRU-A- relief valves (test performance, conditions and results)	7.
	x			16	Events report of February 7, 2002 describing BRU-A relief valves activation, functioning and adverse operational behaviour and reasons	7.
Operation	x			17	Procedures for dedicated Surveillance Program(s) of BRU-A and MSS Valves and Specification of In-Service Monitoring Systems	7.
		x		18	Information on operation experience with BRU-A and MSS valves of the Temelín type and of comparable valve types	7.
RANKING	**I**	**II**	**III**			**Reference APPENDIX I**

Additional WORKSHOP documents[*)]							
Qualification of Valves	x				1	Analysis of functional qualification of NPP Temelín SG Relief Valve BRU-A, Type 1115-300/350. Report DITI, October 2001	7
	x				2	Qualification of BRU-A for two-phase and water flow Report DITI, November 2001	7
	x				3	Application Qualification Report. Qualification of the steam generator safety valves for water and steam-water mixture flow.	7
	x				4	Qualification Report. Environmental Qualification of steam generator relieve [relief] valve (BRU-A) actuator. Report DITI, April 2002	7
						ADDITIONAL SIR	
	x					Unified Procedure for lifetime assessment of components piping in VVER NPPs, in preparation within frame of VERLIFE project of the 5th Framework Program of the EU.	7
	x					Standard Technical Documentation of Association of Mechanical Engineers, Section IV, Residual Lifetime Assessment of VVER NPPs Components and Piping.	7
	x					Standard normative technical documentation A.M.E (Association of Mechanical Engineers (CZ)) for "Strength Assessment of Equipment And Piping of NPP of VVER Type").	7
RANKING	**I**	**II**	**III**			**Reference APPENDIX I**	

[*)] It is understood that key documentation as cited in the individual WORKSHOP documents can also be accessed in the MONITORING Process under way.

APPENDIX I

REFERENCES IN THE SIR RELATE TO THE FOLLOWING ACTIVITIES AS ANNOUNCED IN DOCUMENT

"Sixth Additional Information to the Decision Paper on Chapter 14, Energy' "

(Document CONF-CZ-50/01, Brussels, 2001 09 17).

Reference No. in SIR	#	No.	Activity description	Status	Time schedule
1	2	3	4	5	6
1	1	1.	Preparation of Comprehensive Safety Case on Temelín NPP high energy piping layout at 820 and 826/1 BRU-A and SGSV steam-water mixture qualification (the report will comprise results of steps 2 – 7)	Started 30.1.2001	30.09.2001 1st Progress 30.10.2001 2nd Progress Rep. 30.03.2002 3rd Progress Rep. 30.06.2002 Final Report 30.09.2002 Regulatory Submittal
2	2 3 4 5 6 7 8	2.	• Stress state calculation and measurement including: pipe whip restrain reassessment pipe penetrations reassessment integrity reassessment of steam piping due to water overfill probability calculation according to PRISE methodology (US NRC) in comparison with LBP Pipe (SKI Methodology stress state measurements projects	Finished Finished Started Started Started	10.03.2001 15.08.2001 30.10.2001 30.10.2001 til 2003
3	9 10 11 12 13	3.	• LBB concept application assessment including: comparison with Break Preclusion Concept dynamic loading calculations due to steam water hammer E-C assessment LBB concept application according to the US NRC SRP 3.6.3	Started Finished Started Started	30.10.2001 15.08.2001 15.09.2001 30.04.2002
4	14 15 16 17	4.	• TH analysis of multiple steam and feed water lines breaks in respect: core cooling and final performance PTS situation radiological consequences	Started	15.10.2001 15.10.2001 15.10.2001
5	18	5.	Feasibility study on separation of steam and feed water lines by qualified separation walls design	Started	30.06.2002
6	19	6.	UT Qualification of method, equipment and personnel according to ENIQ methodology for circumferential welds and pipe whip restrain fixation elements, UT testing and assessment of results	Started	30.11.2001 and during outage
7	20	7.	Qualification file development for the BRU-A valve and the SG SV (IPU-Valves) for steam-water mixture performance	Started	30.06.2002

APPENDIX II

Excerpt of MSSV information from:

QUALIFICATION DOSSIERS FOR S-W MIXTURE OF BRU-A AND SGSV INCLUDING EQ OF BRU-A ACTUATOR

by **Jan Fridrich, Rudolf Josífko, Antonin Král, Václav Maxa**
Division of Integrity and Technical Engineering Nuclear Research Institute
Řež plc 250 68 Řež, Czech Republic

Parent Valve Qualification Program, Cont.

- **Steam tests**
  - **4 full cycles with IPV solenoids controlled manually (3) and pressure induced signal (1),**
  - **1 direct mode cycle**
  - **8.4/7 MPa/300°C,**
- **Water tests**
  - **8.5/7.8 MPa, T < 100°C**
  - **4 full cycles with IPV solenoids controlled manually (2) and pressure induced signal (2)**
  - **2 direct mode cycles**

APPENDIX III

FIGURES AND SCHEMES

Revision 1, issued 2003 01 12

Origin on the Figures

Figures	Title	Source
Figure 1	WWER-1000 NPP mock-up in between other exhibiting the 28,8m level area and two main secondary feed water lines	http://www.nucleartourist.com/type/vver.htm
Figure 2	WWER-1000 main steam and feed water lines inside and outside the containment (at 28,8 m level)	Institute of Risk Research, University of Vienna
Figure 3	BRU-A Valve type Chekhov Type 1115-300/350 (WWER-1000)	Jan Fridrich, Rudolf Josífko, Antonín Král, Václav Maxa, (NRI), Qualification Of Steam Generator Safety And Relief Valves, Presentation at the Workshop
Figure 4	WWER-1000 NPP mock-up in between other exhibiting the 28,8 m level area and two main secondary feed water lines	Jan Fridrich, Rudolf Josífko, Antonín Král, Václav Maxa, (NRI), Qualification Of Steam Generator Safety And Relief Valves, Presentation at the Workshop

APPENDIX IV

AUSTRIAN PROJECTS' IDENTIFICATION

Austrian Projects Identifikation

PN 1	Severe Accidents Related Issues	[Item No. 7a]*
PN 2	High Energy Pipe Lines at the 28,8 m Level (AQG/WPNS country specific recommendation)	[Item No. 1]*
PN 3	Qualification of Valves (AQG/WPNS country specific recommendation)	[Item No. 2]*
PN 4	Qualification of Safety Classified Components	[Item No. 5] *
PN 5	Chapter V – Environmental Impact Assessment	
PN 6	Site Seismicity	[Item No. 6]*
PN 7	Severe Accidents Related Issues	[Item No. 7b]*
PN 8	Seismic Design	
PN 9	Reactor Pressure Vessel Integrity and Pressurised Thermal Shock	[Item No. 3]*
PN 10	Integrity of Primary Loop Components – Non Destructive Testing (NDT)	[Item No. 4]*

** The Items are related to ANNEX I of the "Conclusions of the Melk Process and Follow-up"*

APPENDIX V

THE AUSTRIAN SPECIALISTS' TEAM OF CONTRIBUTORS TO THIS DOCUMENT

The Specialists' Work was co-ordinated, synthesised and edited by	
Wolfgang Kromp	Institute of Risk Research, University of Vienna (Austria)
Emmerich Seidelberger	Institute of Risk Research, University of Vienna (Austria)
Geert Weimann	seibersdorf research (Austria)

The Experts of the Austrian Specialists' Team are listed in alphabetical order	
Werner Erath	Kerntechnik Entwicklung Dynamik (Germany)
Helmut Hirsch	Consultant to the Institute of Risk Research (Germany)*
Gueorgui Kastchiev	Institute of Risk Research, University of Vienna (Austria)*
Antonio Madonna	Consultant to the Institute of Risk Research, University of Vienna (Italy)
Steven Sholly	Institute of Risk Research, University of Vienna (Austria)

**) Specialists not participating in the Specialists' Workshop.*

Quality Assurance was assigned to all partners as an integral part of the document review during its development!

MISSION STATEMENT

as adopted by the Austrian Specialists' Team

MONITORING MISSION STATEMENT

The independent Specialists' Team agreed on a "Mission Statement" to define the monitoring process co-ordinated by IRR/ARCS.

"Monitoring" is a process performed in a predefined frame addressing selected issues defined in the "Conclusions of the Melk Process" as well as in the "Roadmap" and the solutions to these issues adopted by the Czech side. Issues and their solutions are monitored on the basis of reference safety criteria and requirements coherent with Safety Approaches accepted in Western Europe. The requirements are ultimately checked against the generally applied Defense in Depth Concept.

The Monitoring has the objective to obtain evidence that adequate solutions have been submitted by the licensee to the licensing authority and that these solutions have been appropriately evaluated and approved by the regulator. Monitoring aims at performing an evaluation of the quality and adequacy of an overall process and the implementation results. The Czech side has offered documentation and discussion opportunities.

The Monitor, in order to form a consistent opinion should be provided with the opportunity to ask for additional information and evidence or request supporting assessments to understand the evidence presented.

Reports of the Austrian Specialists' Team therefore include monitoring results of what has been done, how the applicable requirements have been addressed, how the safety objectives' and requirements' compliance was analysed and justified for the proposed solutions, and how the solutions in the frame of the licensing process and considered in the related regulatory process were evaluated.

The Monitors were not tasked with performing a licensing review of Temelín NPP, and nothing in their reports may be construed to represent any such review. The responsibility for the safety and licensing of Temelín remains with CEZ a.s., the owner of the facility, and with the SÚJB, as the designated nuclear licensing and regulatory authority under Czech law.