UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 6 1982

MEMORANDUM FOR: Joseph D. LaFleur, Jr., Assistant Director for International Cooperation, OIP

FROM: Robert L. Tedesco, Assistant Director for Licensing, DL

SUBJECT: DRAFT REPORT DEVELOPED BY IAEA MISSION ON KRSKO STEAM GENERATOR MODIFICATIONS

Attached for your information is a copy of the subject report. Please contact me if you have any questions regarding this report.

Robert L. Tedesco, Assistant Director
for Licensing
Division of Licensing

cc with enclosures:
H. Denton
D. Eisenhut
R. Vollmer
G. Lainas
W. Kane

Advisory Mission To Yugoslavia (7-12 June, 1982)

SUMMARY

At the request of the Permanent Mission of Yugoslavia to the IAEA an advisory mission including five persons was sent to Yugoslavia during the period 7-12 June, 1982. The purpose was to discuss steam generator vibration problems at the Krsko nuclear powerplant with the licensing authority and plant management and to give advice on associated plant modifications.

After a few months' of initial operation at power the Krsko plant has recently been shut down. Modifications are under way to permit further operation up to 100% power with a limitation on feedwater flow through the main steam generator nozzle. The aim of the flow limitation is to reduce steam generator tube vibration to acceptable levels at full power.

During the Mission's stay in Yugoslavia they formulated a set of recommendations to the Krsko authorities. This includes recommending that the basis for the flow limitation be better developed in quantitative terms ; independent design review of plant modifications be completed on a timely basis ; operating programme be established to specify permissible operating modes during a pre-established limited operating time period ; comprehensive start-up testing programme be established and operator training be conducted prior to resumed operation ; and adherance to quality assurance requirements be ensured prior to operation of the plant as modified. The basis for these and other recommendations are discussed in the present report.

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NENS, NENF, NENP
ADLG, Mr. Ha Vinh
Public Information
Registry (2) - File

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ADVISORY MISSION TO YUGOSLAVIA

7 - 12 June, 1982

J.M. Izquierdo	Junta de Energia Nuclear, Spain
I. Jung	Consultant, Sweden
L.G. Larsson	Nuclear Power Inspectorate, Sweden
R.L. Tedesco	Nuclear Regulatory Commission, USA
L.I. Tirén	IAEA

PREAMBLE

The Director General of the IAEA would like to place on record his understanding that, upon completion of its work, the Mission may make to the Yugoslav authorities and to the organization responsible for the operation of the nuclear power plant such recommendations as the Mission considers desirable regarding the measures that should be taken for ensuring the safe operation of the plant. The Mission's recommendations will be made on its own expertise and will not engage the IAEA in any way or imply any commitment on the part of the IAEA.

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1. INTRODUCTION

In a letter dated 27 April 1982 the Permanent Mission of the Socialist Federal Republic of Yugoslavia to the IAEA requested the assistance of an Agency team of experts to discuss steam generator vibration problems in the Krsko nuclear power plant.

In response to the request, the Agency sent a mission to Yugoslavia during the period 7 - 12 June, 1982, consisting of the following four experts:

J.M. Izquierdo	PWR Startup Group Leader
(7-11 June)	Evaluation Division,
	Junta de Energia Nuclear, Spain
I. Jung	Professor Emeritus
(7-11 June)	Steam Technology,
	Royal Institute of Technology,
	Stockolm, Sweden
	Consultant to the Swedish State Power Board
I.G. Larsson,	Director, Office of Inspection
	Nuclear Power Inspectorate,
	Sweden

R. L. Tedesco (7-11 June) — Assistant Director for Safety Assessment
Division of Licensing,
US Nuclear Regulatory Commission
Washington, USA

Mr. L.I. Tirén from the Nuclear Safety Division of the IAEA also participated as the Scientific Secretary for the Mission.

During its stay in Yugoslavia the Mission mainly interacted with staff of the following organizations :-

- State Committee of Energy of the Socialist Republic of Slovenia (acting as the regulatory body for the Krsko nuclear power plant).

- Institute "Jozef Stefan", IJS (technical advisory body to the State Committee)

- Nuklearna Elektrarna Krsko, NEK (Krsko nuclear power plant utility)

- Westinghouse Electric Corporation (vendor of Krsko nuclear power plant)

The present report gives a summary of the work including recommendations of the IAEA Mission.

The Agency is obliged to the Governments of Spain, Sweden and the United States, and to the experts assigned, for their prompt response to the Agency's request for consultation. This request appeared at a time when the experts in the three countries were heavily involved in the problems of their own plants. The effective arrangements made by the Yugoslavian authorities for the Mission are also greatfully acknowledged.

2. MISSION OBJECTIVES

Steam generator tube vibration is a concern in the operation of recent Westinghouse designed nuclear power plants, including the Krsko plant. This concern has led to a proposal at Krsko to modify the feedwater system before continuation of the start-up programme. The purpose of the Mission was to discuss the current situation, particularly with regard to safety, with members of authorities and Krsko plant staff. In particular, the Mission was asked to give comments and advice on :

- proposed feedwater system modification, including changes in the control system

- resumed operation of Krsko with regard to the steam generator tube vibration problem

- necessary documentation, evaluation and review to accept further operation of the plant as modified.

3. BACKGROUND AND CURRENT SITUATION

3.1 STEAM GENERATORS

The Krsko nuclear power plant is a PWR plant of 664 MW gross electric power output. The main contractor is Westinghouse Electric Corporation. The plant has two main coolant loops equipped with type D4 steam generators. It is the first plant with this type of steam generators to go into operation. The D4 type includes a preheater section with cross-flow characteristics. The concern with regard to tube vibration stems from the fact that fluid induced vibrations have been experienced in preheat type steam generators used in PWR plants in Spain (Almaraz 1), Sweden (Ringhals 3) and the U.S.A (McGuire 1). These plants, however, have steam generators of somewhat different designs (Almaraz and Ringhals type D3, McGuire type D2). The most important difference is in the area of initial distribution of feedwater through the main nozzle. In the D2 and D3 types, the inlet flow is distributed upwards and downwards into the preheater tube area via an impingement plate. In the D4 type, on the other hand, all the incoming flow is directed downwards towards the bottom part of the preheater section. Common to all these steam generators, however, is the flow perpendicular to the tubes, directed by baffle plates in the preheater area (see figure 1 and 2). As a result of fluid induced vibrations, significant tube wear in the tube-to-baffle plate intersections has been experienced in the Ringhals 3 and Almaraz 1 steam generators.

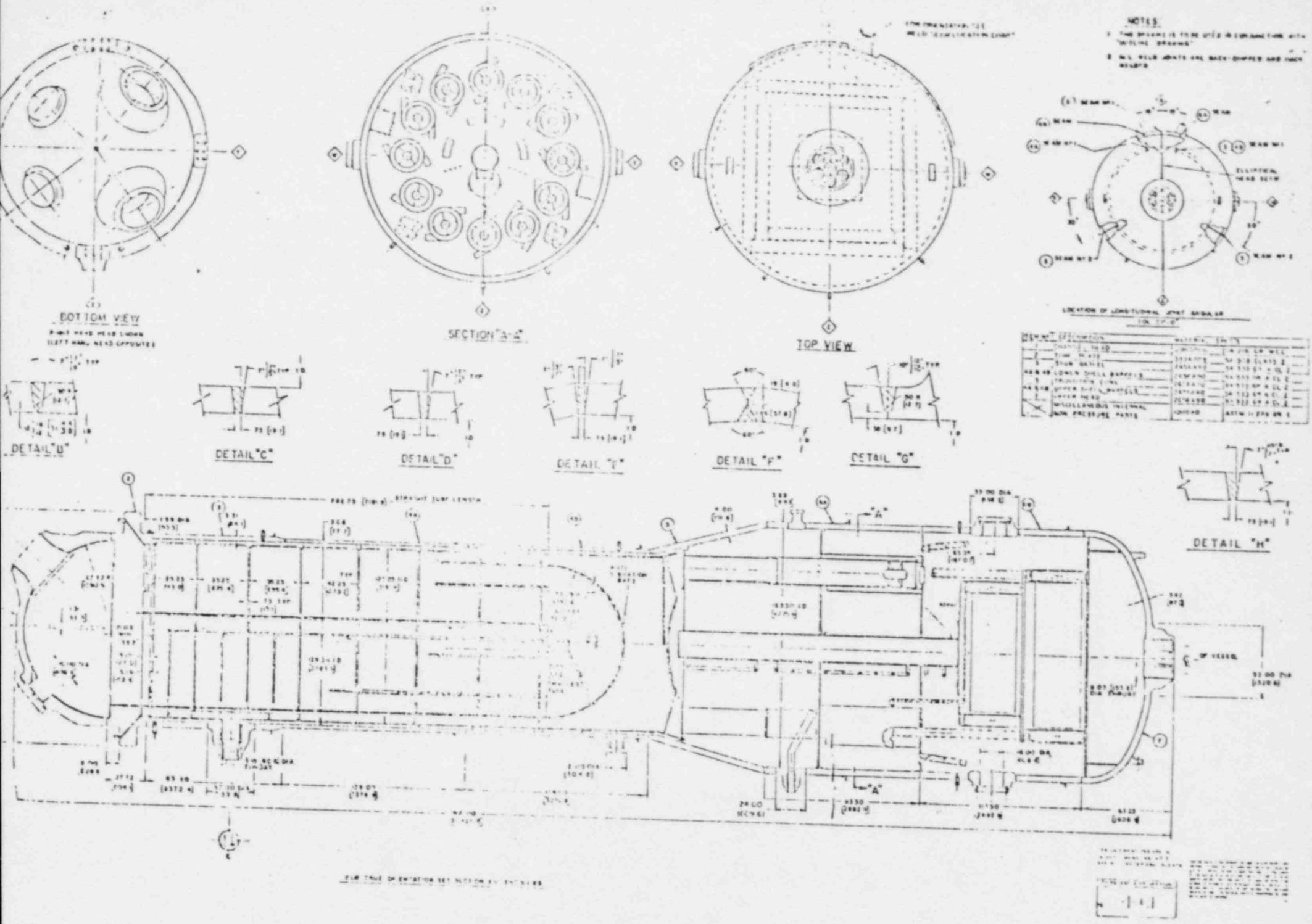
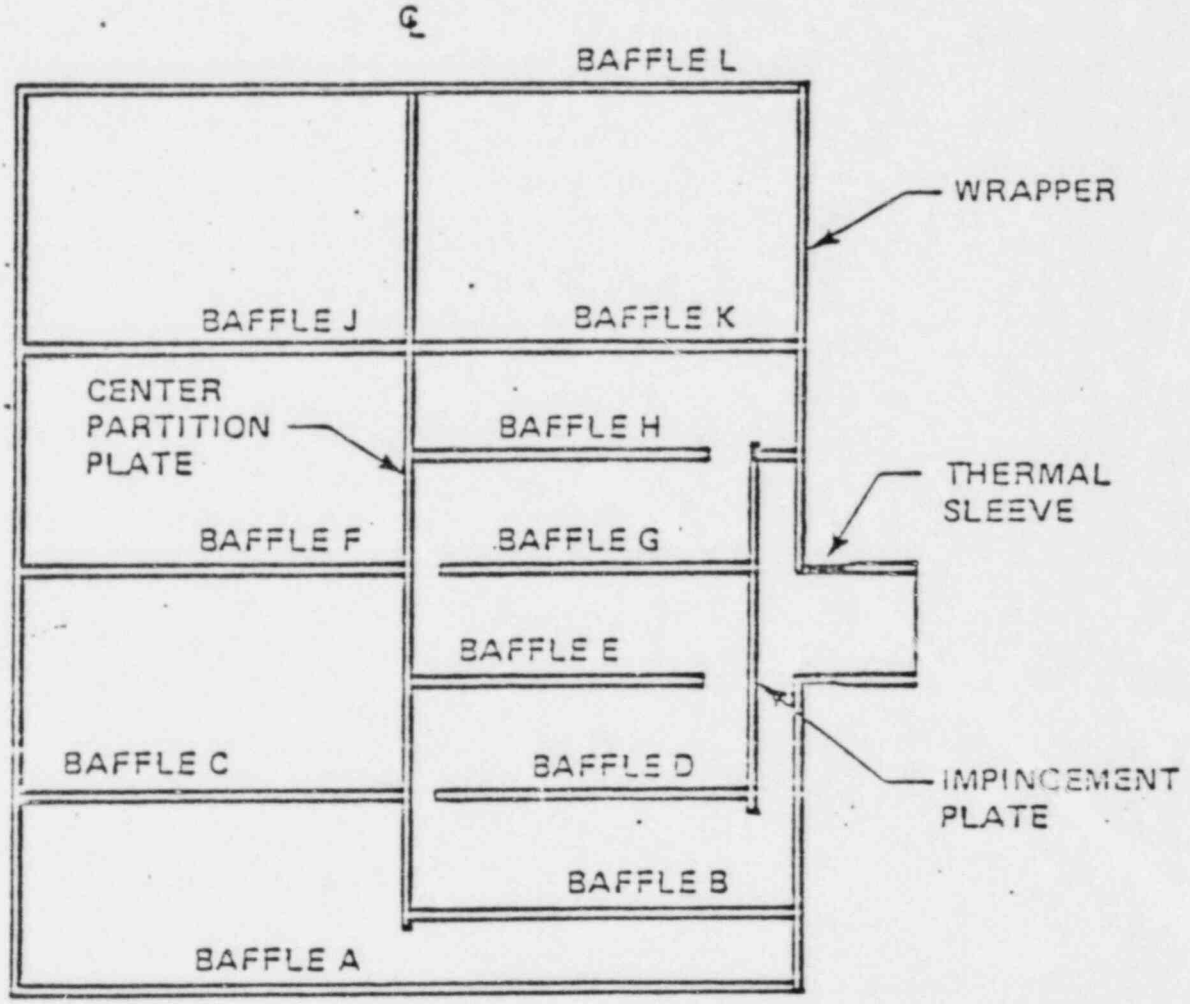


FIGURE 1-2 - General Arrangement

MODEL D4 LOWER SHELL INTERNALS



3.2 KRSKO OPERATING EXPERIENCE

The plant was synchronized to the external grid for the first time on 2 October 1981, and load testing at 75% power was successfully completed on 23 December. In order to study possible tube vibration, accelerometers were installed on four steam generator tubes in the preheater area in January 1982. The plant was subsequently operated at varying power levels from February to May, 1982. The operation included approximately 1500 hours at 70% and short intervals at 100% power (see operating record, Annex III).

Accelerometer recordings made by the vendor during this operation indicated steam generator tube vibrations increasing with feedwater flow. The measurements were compared with similar observations at Almaraz and Ringhals. As a result, the vendor determined that some modification to the Krsko plant was necessary to permit the plant to be operated at full power. The plant was shut down on May 14, 1982, and eddy current tests (ECT) were performed on steam generator tubes. No indication of tube wear was found as a result of these tests.

At the time of the Mission's stay in Yugoslavia, one of the intrumented steam generator tubes was cut and pulled out for further examination. The Mission experts were also given the opportunity to inspect the tube visually. There were some marks visible on the tube, at the locations of tube-to-baffle plate intersections, but they were considered to be quite superficial and any depth of wear far below the level detectable with ECT.

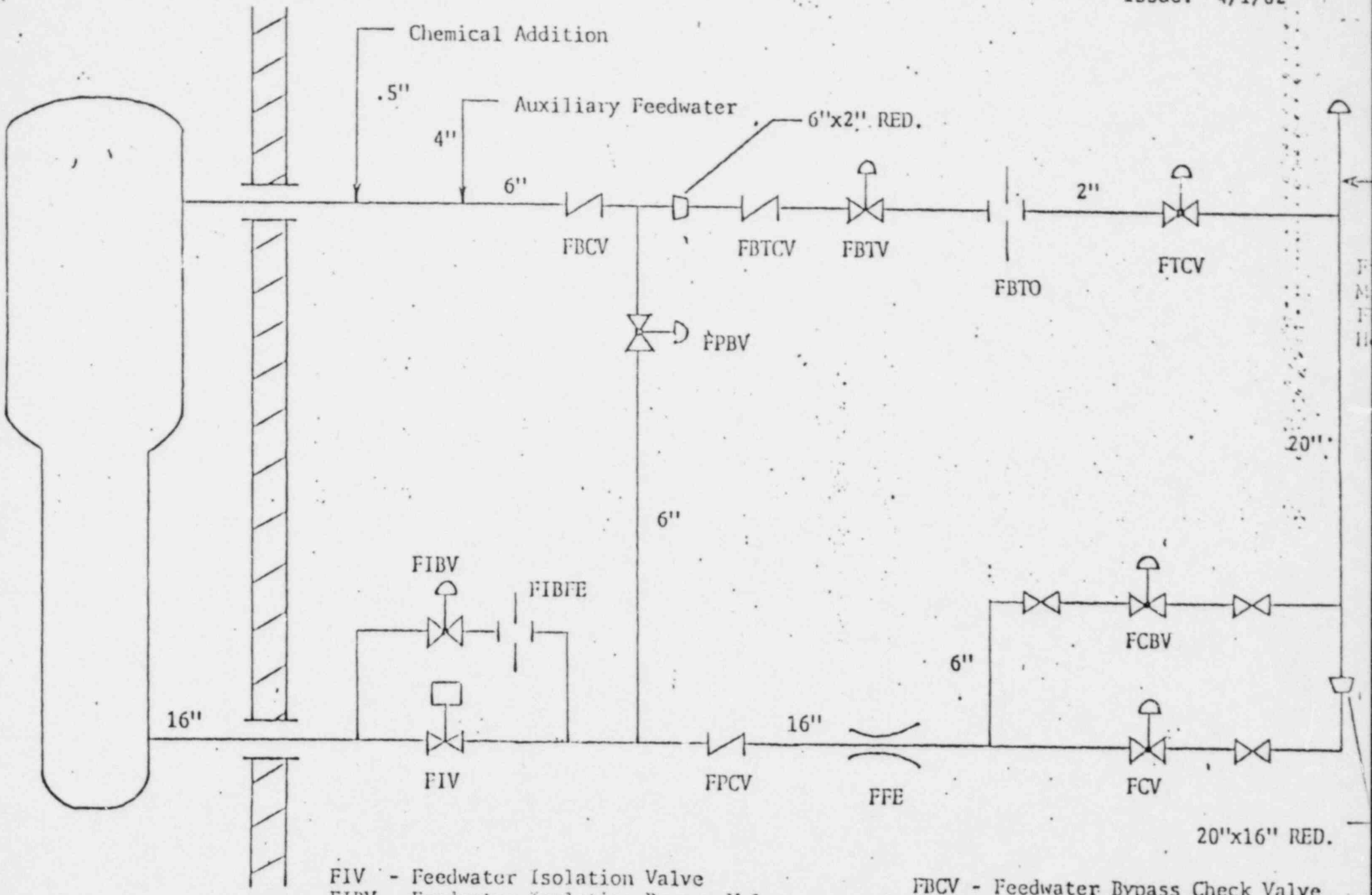
3.3. PROPOSED MODIFICATION AND PLANS FOR RESUMED OPERATION

Based on the experience of observed tube vibrations in Krsko and comparison with similar data from other plants the vendor concluded that steady state feedwater flow through the main nozzle should be limited to 70% of nominal flow at full power. The vendor then developed a proposal to modify the plant to keep within this flow limit while retaining the possibility to reach 100% power. The basic change is to redirect 30% of the feedwater flow at full power from the main nozzle to the top auxiliary nozzle of the steam generators. This entails a substantial modification of the feedwater system, including new piping and valving (see figures 3 and 4) as well as major changes of the feedwater and steam generator control systems.

The proposed modification has been accepted in the sense that the necessary hardware changes are now under way, and operation of the plant as modified is planned to be resumed in July 1982.

The authorities recognize that operation of the plant as modified will be on a trial basis. While there is hope that the modification now being undertaken will be adequate as a final solution to the problem, proof to this effect has still to be awaited. Renewed start-up tests, operating experience with the modified control system and, in particular, future ECT, will have to be evaluated carefully as a basis for future conclusions in this respect.

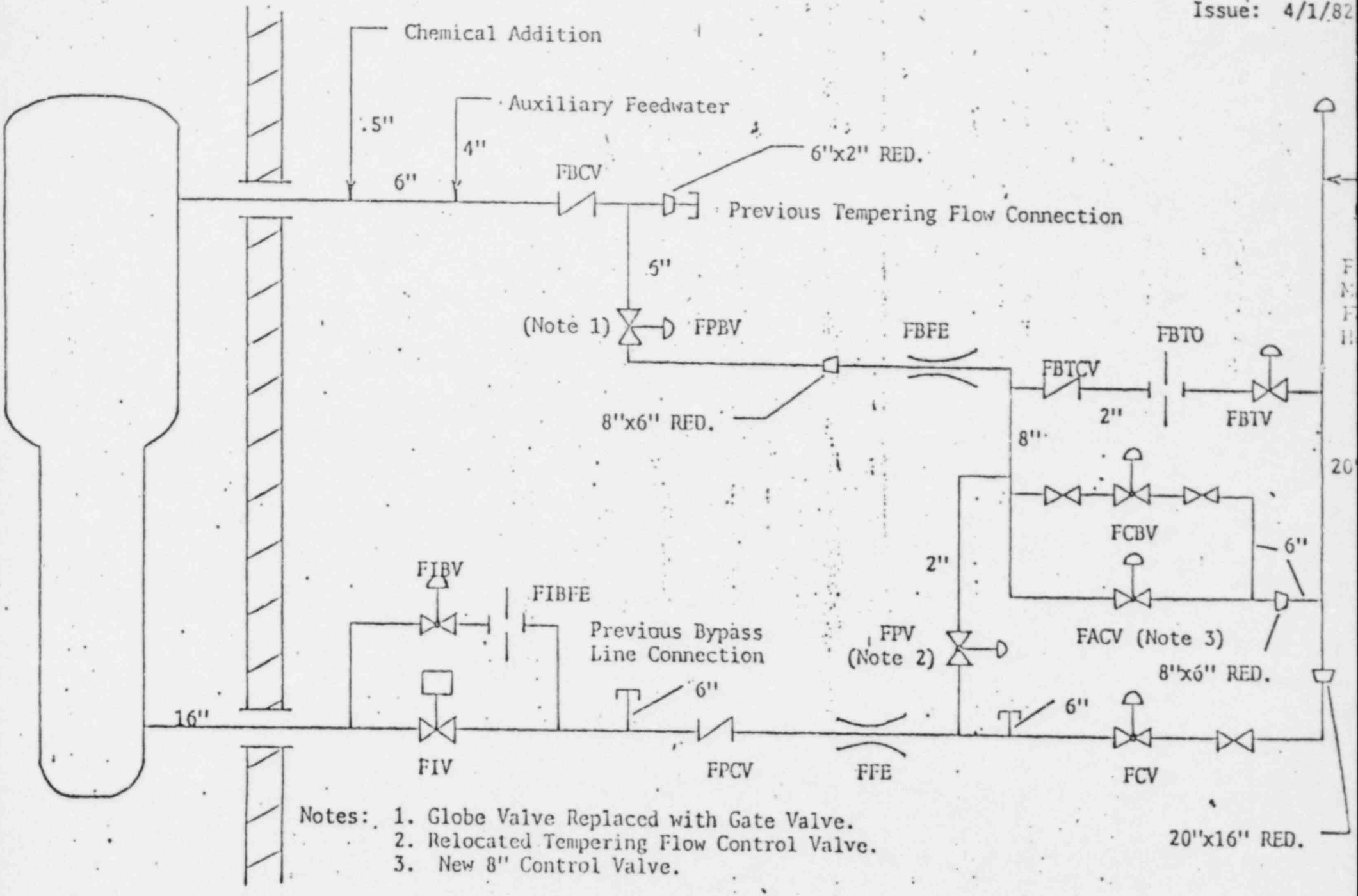
Issue: 4/1/82



FIV - Feedwater Isolation Valve
FIBV - Feedwater Isolation Bypass Valve
FIBFE - Feedwater Isolation Bypass Flow Element
FPCV - Feedwater Preheater Check Valve
FCV - Feedwater Control Valve
FCBV - Feedwater Control Bypass Valve

FBCV - Feedwater Bypass Check Valve
FBTCV - Feedwater Bypass Tempering Check
FBTV - Feedwater Bypass Tempering Valve
FBTO - Feedwater Bypass Tempering Orifi
FTCV - Feedwater Tempering Control Valv

Issue: 4/1/82



Notes:
1. Globe Valve Replaced with Gate Valve.
2. Relocated Tempering Flow Control Valve.
3. New 8" Control Valve.

CV - FW Preheater Check Valve
V - FW Isolation Valve
BV - FW Isolation Bypass Valve
- FW Control Valve

FBFE - FW Bypass Flow Element
FFE - FW Flow Element
FBTV - FW Bypass Tempering Valve
FBCV - FW Bypass Check Valve

FIBFE - FW Isolation Bypass Flow Element
FBTO - FW Bypass Tempering Orifice
FBTCV - FW Bypass Tempering Check Valve

The Mission received no detailed operating plan, and no definite limit was given on operating time before the next ECT. However, the plant technical director indicated that new ECT is envisaged to be performed in the autumn of 1982.

3.4 ASSISTANCE GIVEN TO KRSKO AUTHORITIES

The Committee of Energy of the Slovenian Republic is advised by the Institute Josef Stefan in safety matters for the Krsko plant. The IAEA has also, through the years, provided frequent assistance to the Yugoslav authorities on many different aspects of the Krsko project. Other organizations are involved in specific areas of consultation. For example, the Krsko utility, NEK, employs the NUS Corporation as a consultant.

The Yugoslav authorities have recently requested assistance by the US NRC in evaluating safety aspects of the steam generator related modification to the plant. During the Mission's stay in Yugoslavia, interim comments from he US NRC were received. The comments were based on documents provided by a Yugoslav delegation at a 25 May, 1982 visit to the NRC. The Mission was given the opportunity to read the NRC comments and found them reflecting an in-depth approach taken ~~the~~ by the US NRC in reviewing the matter. This development, in conjunction with the reviews made by the Institute Jozef Stefan, gives assurance that the Yugoslav authorities will continue to receive adequate guidance in safety matters related to the current steam generator problem.

4. RECOMMENDATIONS AND DISCUSSION

The present section of the report is a revised version of draft recommendations and discussion handed over to the Yugoslav authorities during the Mission's stay in Yugoslavia.

The Mission had the benefit of reviewing various design studies covering the proposed modification to the D-4 Krsko steam generator. In addition, the Mission met with representatives of the licensing authority, the utility and the vendor to further discuss the proposed design modifications. On the basis of its study, the Mission developed a number of recommendations that are set forth in this section of the report. It believes that due consideration should be given to these recommendations and appropriate actions taken prior to plant start-up following modifications that will be made in the feedwater system. It is to be noted that the recommendations presented relate to the Krsko plant and do not necessarily apply to other similar plants without further evaluation.

Recommendation No. 1

The Mission recommends that the basis used to establish the 70% main feedwater flow through the steam generator preheater section should be better developed in more quantitative terms, i.e. relating feedwater flow rates to vibration frequencies, amplitudes and, in particular, wear rates.

Discussion

Westinghouse representatives at the meeting held on June 8, 1982, at the Krsko site discussed some recent test results obtained from internal instrumentation installed on the D-4 Krsko steam generators.

The data presented to the Mission showed minor vibration effects at a power level of 50%. The acceleration spectrum broadened and amplitudes increased with increased power and feedwater flow rates. The data extended to the case of 100% power and flow rate. These measurements, correlated with similar data from other plants, form the basis for the assumption that no damaging tubes vibrations will occur in the Krsko steam generators operating with a feedwater flow through the main nozzle in the 70% range. This is also the basis for the proposed feedwater system modifications. However, the vendor has not yet determined whether a correlation of tube wear with the Krsko test data can be made.

The Mission believes that a more deterministic correlation should be made to better ensure the acceptability of the proposed 70% flow limit. In addition, estimates of margin should be developed to establish conservative permissible upper limits for the proposed initial operating programme. Additional test results are necessary to quality the acceptance of extended operation at the proposed 70% main feedwater flow limit. Such results would also be useful in developing future tube plugging limits in accordance with US NRC Regulatory Guide 1.121.

A review should be made to ensure that the tubes chosen for vibration measurements constitute a conservative sample so that no detrimental vibration exists in other tubes. In addition, consideration should be given to the completness of the model tests performed with D-4 type steam generators.

Regardless of the lack of criteria, it is, however, the opinion of the Mission that the Krsko plant, from steam generator tube wear point of view, can be safely operated for limited periods, pending further confirmatory studies and ECT at the proposed operating conditions.

Recommendation No. 2

The proposed modification of the feedwater system is extensive. The Mission recommends that the independent design reviews of this modification be completed on a timely basis. The review should include mechanical and thermo-hydraulic aspects as well as those relating to control and protection system modifications.

Discussion

The Mission notes that, in addition to the design review made by the Institut Josef Stefan, the authorities now receive assistance by the US NRC in this matter. The independent review should deal with selected design aspects to provide added assurance of the overall adequacy of the proposed modifications.

With regard to the steam generators, the Mission identified the concern of vibration of the intermediate deck plate due to the increased auxiliary nozzle flow injection.

Reduced flow through the preheater section (from 100% to 70% flow) may lead to increased steam formation at the bottom part of the preheater. The Mission was informed that the vendor did not expect any water hammer hazard to develop as a result of increased steam generation. A criterion was quoted under which no net vapour formation should occur in the four first passes of the preheater. This criterion would also be met at the reduced flow operation. However, the basis for this criterion was not fully clarified.

The reduced flow could also result in sludge deposition at steam generator tube-to-baffle plate intersections. Again, the vendor's evaluation showed that sufficient flow velocities are maintained to prevent sludge deposition. However, it is the Mission's opinion that these concerns justify careful monitoring during initial start-up and subsequent plant operation.

Results from model tests in Sweden have shown extremely high and instable flow velocities after the main feedwater restrictor nozzle in the D-3 type steam generator. For this reason, the Mission would recommend that the exchange of this restrictor by a multi-venturi nozzle restrictor should be considered for Krsko as a means to reduce the velocities and to provide a more uniform flow distribution into the downcomer channel. This should ensure a steady flow entrance to the preheater tube-bank.

It is the Mission's view that the design review may be made in conjunction with initial plant operation but should be completed as a prerequisite for acceptance of the modification as a permanent solution.

Recommendation no. 3

The Mission recommends that careful consideration be given to ensure that there would be no adverse interactions between the control and safety features of the feedwater system.

Discussion

The proposed modifications include changes to the reactor protection system, the feedwater control system and the auxiliary control system. The effects of such changes with regard to possible adverse system interactions should be fully understood, especially under transient and accident modes and at various flow conditions. Of particular concern would be the effect of the proposed changes on overcooling transients, transients involving switch-overs (e.g.load rejections), and other such events included in Chapter 15 FSAR analyses. Further, no adverse failures in the control system should preclude the operation of any safety function.

The set-point study should be revised to take into account control system modifications.

The proposed modification includes deletion of the steam/feedwater flow mismatch trip. Westinghouse informed the Mission that no credit has been taken for this trip in the safety analysis of the plant. The Mission was also informed by telephone on June 10, 1982, that the US NRC has accepted the deletion of this trip as a generic change.

Recommendation no. 4

The Mission recommends that an operating program be established to specify permissible operating modes at various main feedwater flow rates through the main nozzle and allowed short term operation at rates above 70%. The initial operating program should include a definite operating time limit at 70% flow until the next ECT is to be performed.

Discussion

At the meeting held on June 8, 1982, it was not apparent that operating limits had been fully evaluated. Permissible operation at 70% flow for a specified time period prior to the next ECT inspection should be established prior to plant restart. In addition, off-normal conditions wherein flow in the preheater could exceed 70% should be evaluated. This includes consideration of a maximum limit, and permissible times for anyone event or number of events where 70% flow would be exceeded.

The merits of a passive device versus the present flow alarm for limiting the flow should be evaluated especially with regard to excess feedwater transients.

Recommendation no. 5

The Mission recommends that, prior to operation in the proposed mode, a comprehensive start-up testing programme should be established. Test during the start-up phase should be performed to confirm predictions. In addition, operator training should be conducted prior to operation in the proposed mode, to account properly for the modified operating procedures.

Discussion

Clearly the proposed changes to the operation of Krsko involve new demands on the part of the operator to properly respond to plant changes. This is especially true in the ranges where flow changes and flow-split occurs. Westinghouse should provide technical bases for system operations to establish the start-up test programme. The results of previous tests should be re-evaluated. Subsequently, proper detailed operating procedures should be prepared, reviewed and approved prior to plant start-up for the new operating modes. In addition, control system stability and the possible change in the potential for adverse water hammer in the preheater and auxiliary piping of the feedwater system should be investigated and procedures verified to deal with such evenrs.

Recommendation no. 6

The Mission recommends that the new operating characteristics in the preheater secion with the revised flow-split be evaluated to assure that no adverse changes will occur in thermal and hydraulic design basis for the D-4 steam generator.

Discussion

Further studies are needed regarding the flow distribution in the D-4 steam generator. Better understanding appears to be needed about the flow through the auxiliary feedwater nozzle and how it may affect main feedwater flow at various power levels. The consequences of using the auxiliary feedwater piping and nozzle should be evaluated using conservative assumptions of auxiliary feedwater flow and temperatures considering critical system malfunction.

Those portions of the transient and accident analysis, contained in Chapter 15 of FSAR, which are affected by the modifications should be identified. The safety analysis should be revised as necessary and should then be reviewed independently.

It must be understood that the modifications will result in a small decrease in plant thermal efficiency. In this context, the Mission was informed about plans to increase primary coolant average temperature by approximately 1.5^{o}F in order to improve thermal efficiency. The Mission is concerned that such a change may have implications which have not been clarified in the area of safety margins and should therefore not be attempted until consequences of other modifications have been reviewed, and operation of the plant as modified has progressed

Recommendation No. 7

The Mission recommends that, as additional information becomes available from the Krsko and other ongoing related programmes, the proposed modification and operating program should be reevaluated and programatic changes be made as appropriate.

Discussion

As in any program of the type being investigated at Krsko, due attention must be given to the utilization of any new understanding or information that may become available. Apparently, the vendor will be in a position to provide additional information, due to his involvement with other similar plants. This information would serve to help the utility to better assess the full impact of steam generator vibration problems on the operation of the Krsko nuclear power plant. Every effort should be made to provide such information as it becomes available.

In addition, the licensing authority is encouraged to continue establishing good contacts with the authorities in the countries with D-2, D-3 and D-4 steam generators.

Recommendation No. 8

The Mission recognizes the wide-spread impact of the modifications on the Krsko plant. Accordingly, careful attention must be given to the quality assurance (QA) aspects associated with all the changes being made to ensure that the modifications have been carried out in accordance with the stated objectives for plant operation.

Discussion

Recent experience at other nuclear facilities involving plant design and construction activities have shown the need for establishing an adequate Quality Assurance programe to ensure that proper desgin verification and plant modifications are carried out according to stated objectives in the FSAR as amended. Similar concern is applicable to the modifications being proposed at the Krsko plant for the feedwater system. The utility should ensure the adequacy of their QA programme so that the proposed changes are implemented in the intended manner. This involves such activities as design control and plant walk-down to ensure proper implementation of the required changes prior to operation. In addition, QA for operation should be included to cover appropriate operation aspects.

APPENDIX I : SUMMARY OF MISSION ACTIVITIES

Sunday, 6.6

The Scientific Secretary for the Mission met with Dr. Milan Copic of the State Committee of Energy of the SR of Slovenia. The objectives of the Mission were discussed and major items for the agenda were identified.

Monday, 7.6

Initial presentations and discussions were held at the Krsko plant with the Mission and representatives of the State Committee of Energy, the Institut Jozef Stefan, and the Krsko utility, NEK. The present situation at the plant was explained and the major problems of the steam generators and plant modification were outlined by the NEK Technical Director. A flexible agenda for the Mission's work was agreed upon.

Information material in the form of the FSAR with amendments and other documents was provided to the Mission.

A short tour of the plant was made.

Tuesday, 8.6

Additional documents were provided to the Mission, including a series of questions raised by the Krsko utility and vendor responses

regarding the steam generator vibration problem and the proposed feedwater system modification. Written comments made by the Institute Jozef Stefan were also given to the Mission for information.

The day was mainly spent by the Mission in examining the documents received as a basis for their findings and conclusions.

The Mission made a visual inspection of a steam generator tube pulled out for further detailed examination by vendor and utility experts.

Wednesday, 9.6

In the morning, presentations were given by representatives of the vendor. The presentations included an account of steam generator tube vibration measurements, a description of the feedwater system modification, and a more detailed presentation of proposed changes to the control and protection system. The Misson was given ample time to put questions to the vendor experts.

Based on the information given, the Mission members discussed among themselves their views on the current problems. These discussions continued for the remaining part of the day. A set of Mission findings and responses to the concerns expressed by the licensing authority and the Krsko utility was drafted.

Thursday, 10.6

The initial Mission draft findings were handed over to the licensing authority and Krsko utility representatives for their comments. A discussion on the draft was held, with participation from the State Committee of Energy, the Institut Jozef Stefan, the Krsko utility and the NUS consultant firm.

The Mission then spent the remaining part of the day in formulating and supplementing their draft recommendations. The new draft was given to the State Committee representative at the end of the day.

Friday, 11.6

In the morning, a presentation was given by Professor Ingvar Jung. This was made on the request of the State Committee of Energy of the SR of Slovenia and dealt with the current steam generator tube wear problem at the Ringhals 3 plant as well as related research, tests and development in Sweden. The Swedish State Power Board (Ringhals utility) and Westinghouse are conducting tests on a full scale model of a section of a Ringhals steam generator (see Appendix II of this report).

The new Mission draft recommendations were then discussed with the Yugoslav representatives, including additional explanations by the Mission.

Three of the Mission members left Yugoslvia on this day.

Saturday, 12.6

The remaining Mission members continued discussing the draft recommendations, mostly with regard to editing items, and also the structure of the final report to the Government of Yugoslavia.

Appendix II

To be included later

Appendix III

NPP KRŠKO START-UP AND OPERATING HISTORY

COLD HYDRO COMPLETION	April 19,1981
HOT FUNCTIONAL COMPLETION	November 10,1980
CORE LOAD	May 5 to 9, 1981
FIRST CRITICALITY	September 11,1981
FIRST SYNCHRONIZATION	October 2,1981
75 % load testing successfully completed	December 23,1981

Energy production from October 2,1981 to May 15,1982:

Gross produced energy 1.144 GWh

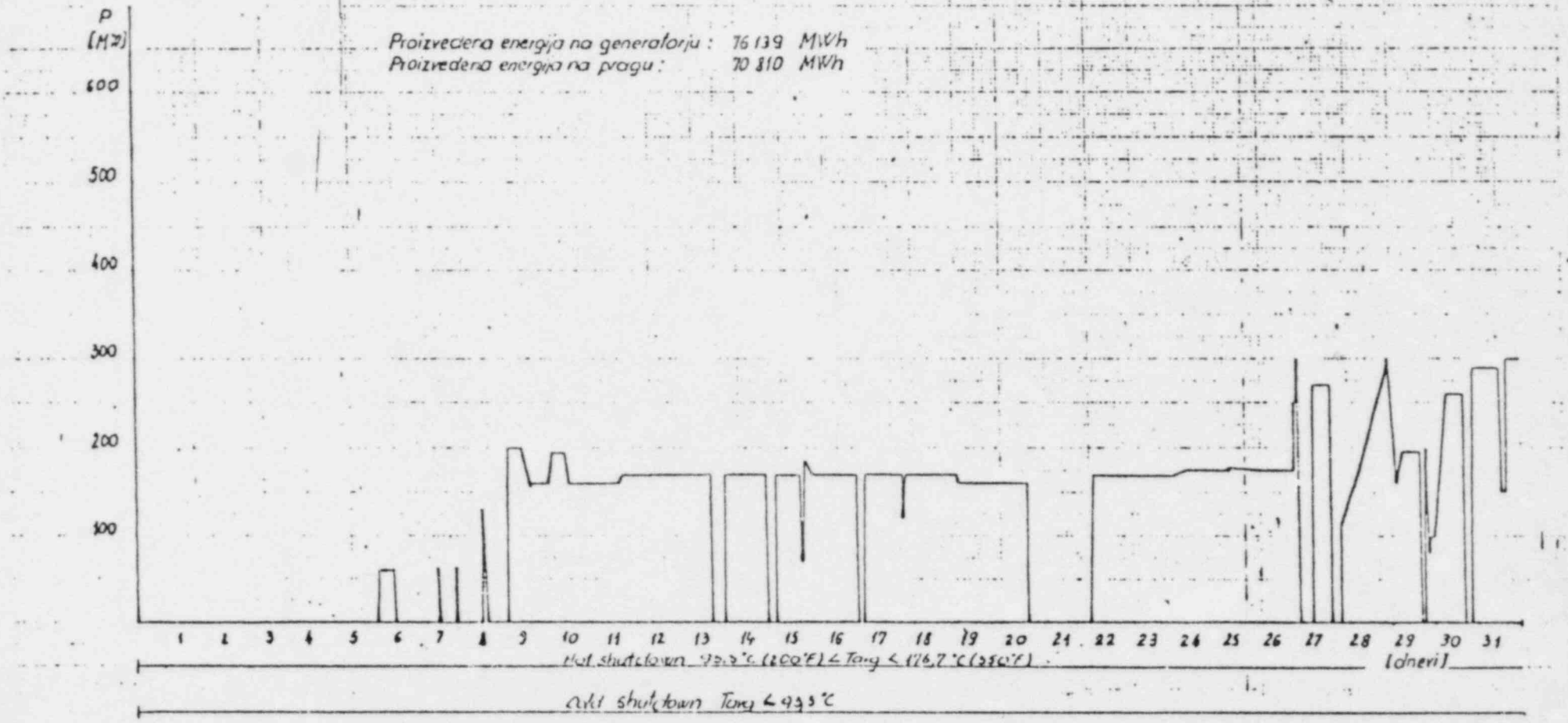
Net produced energy 1.083 GWh

Krško, June 11,1982

OCTOBER, 81

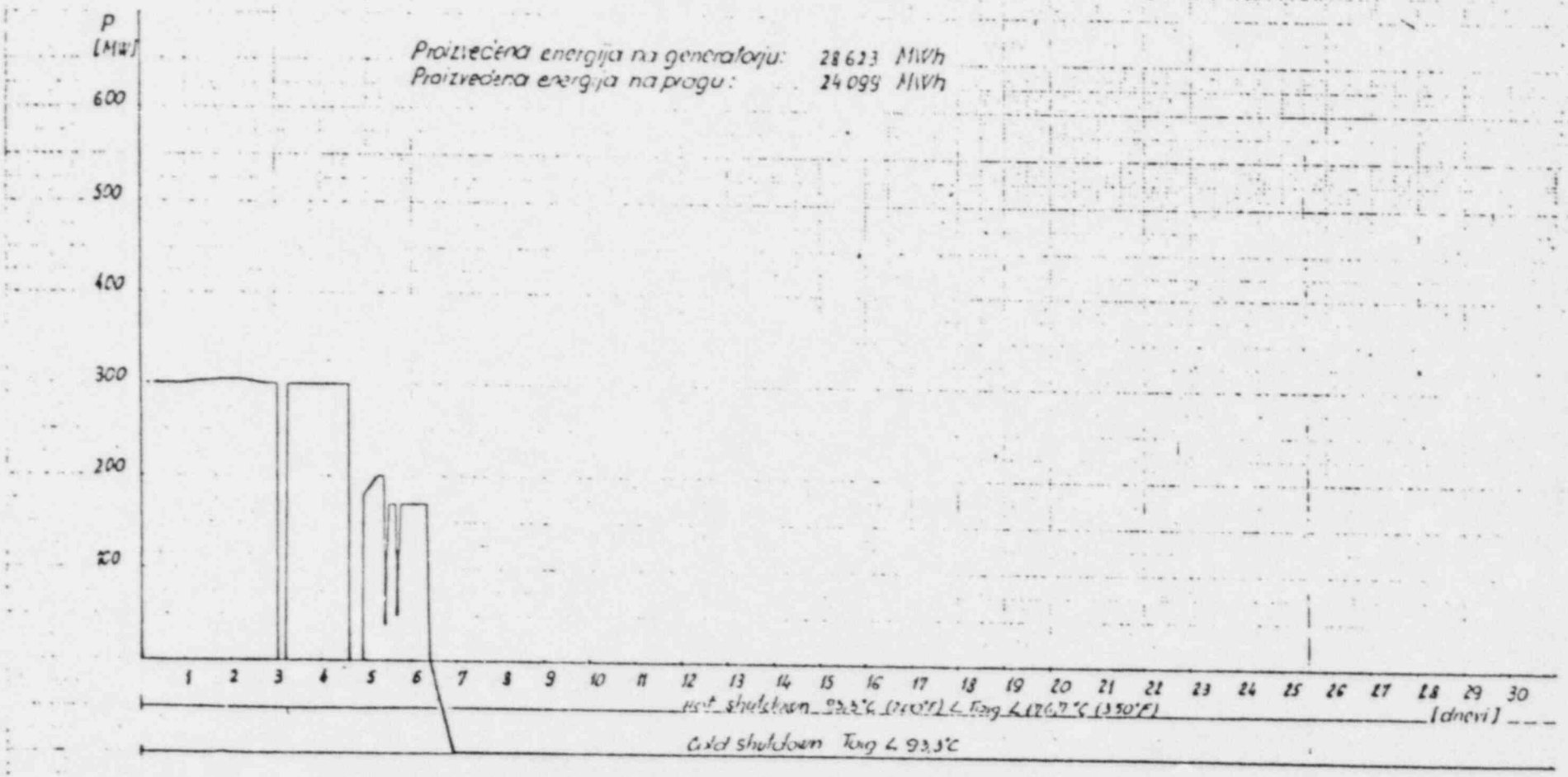
DIAGRAM OBRATOVANJA NE KRŠKO za mesec OKTOBER 1981

Proizvedena energija na generatorju : 76 139 MWh
Proizvedena energija na pragu : 70 810 MWh



NOVEMBER, 81

DIAGRAM OBRATOVANJA NE KRŠKO za mesec NOVEMBER 1981

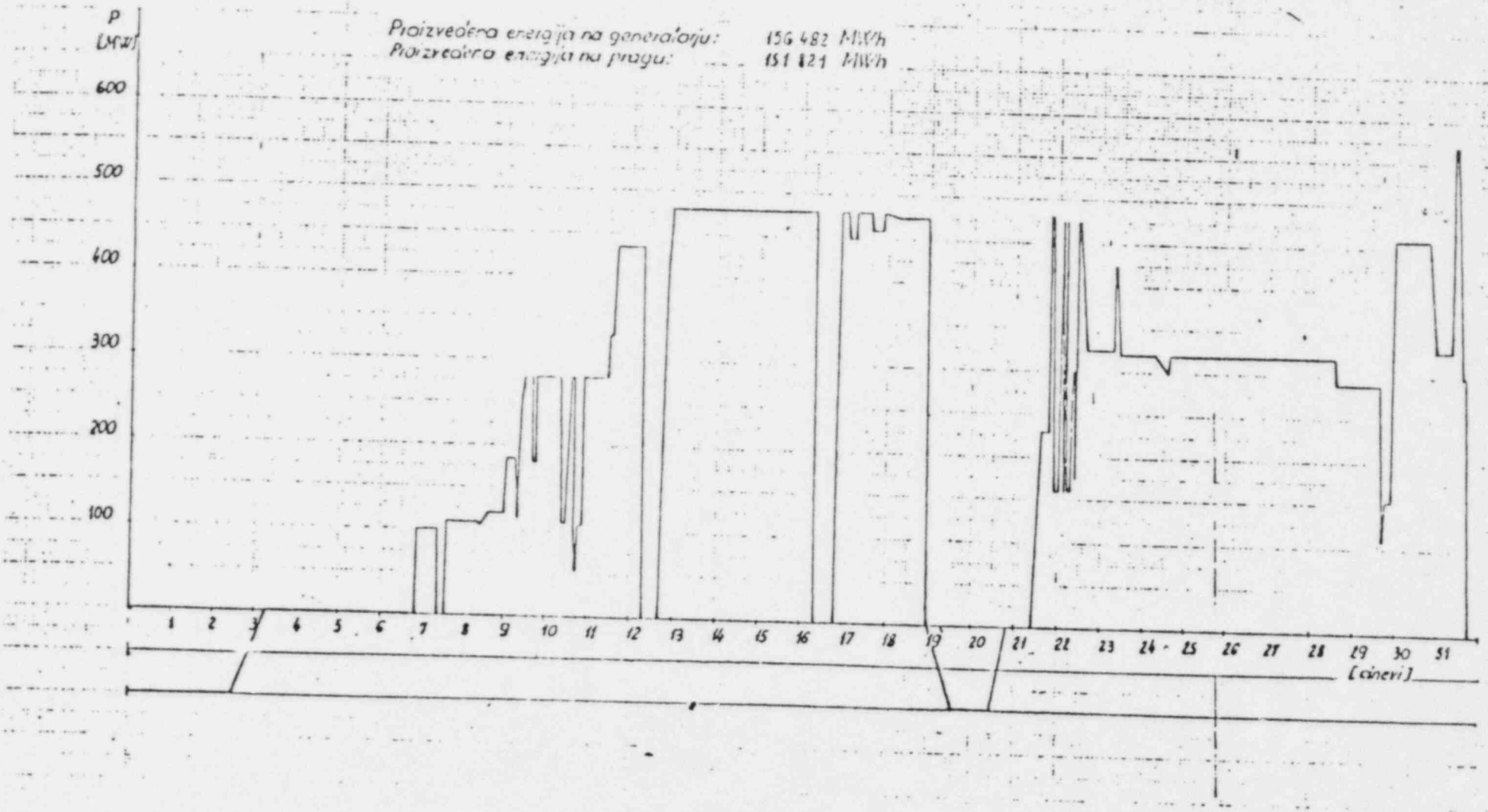


Proizvedena energija na generatorju: 28623 MWh
Proizvedena energija na pragu: 24099 MWh

DECEMBER, 81

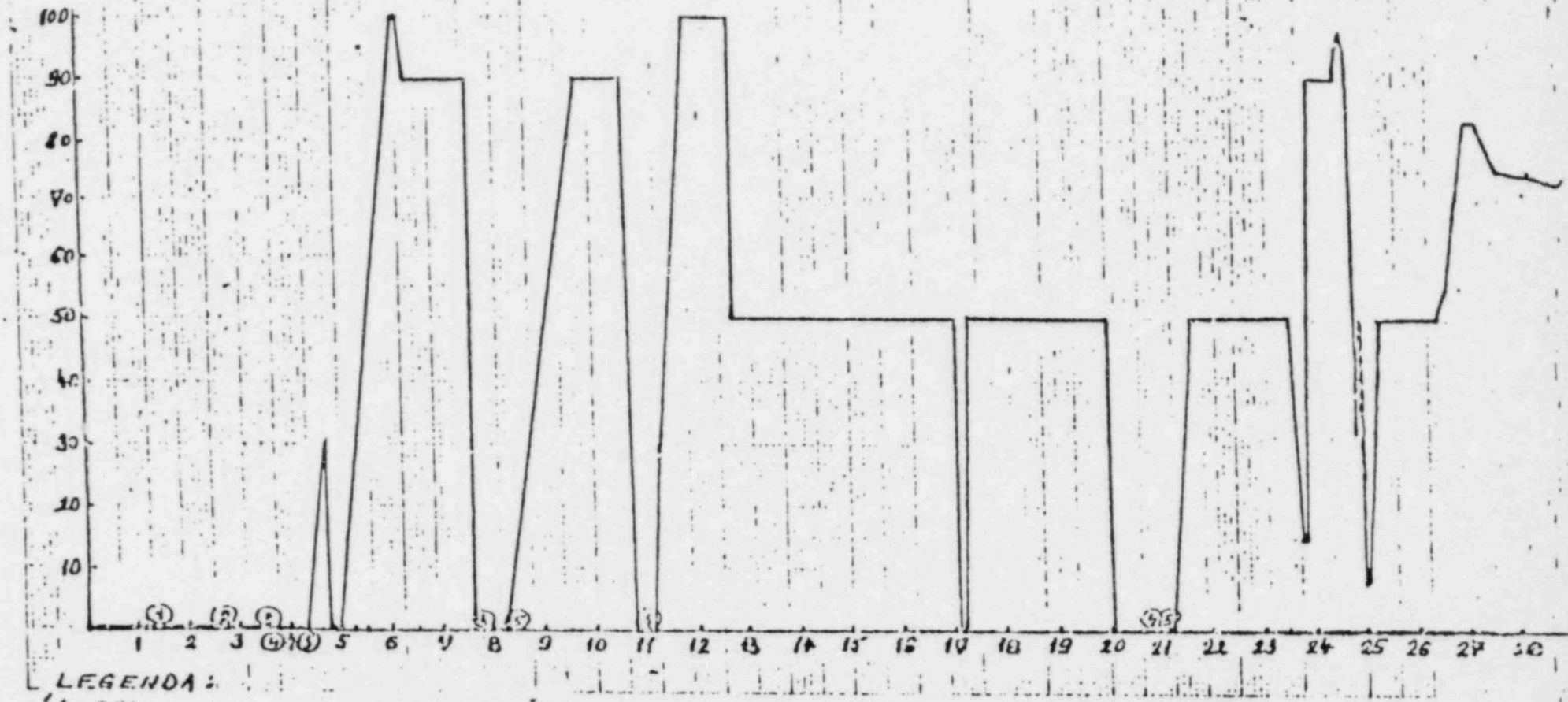
DIAGRAM OBRATOVANJA NE KRŠKO za mesec DECEMBER 1981

Proizvedena energija na generatorju: 156 482 MWh
Proizvedena energija na pragu: 151 821 MWh



FEBRUARY, 82

DIAGRAM OBRATOVANJA NE KRŠKO ZA FEBRUAR 1982



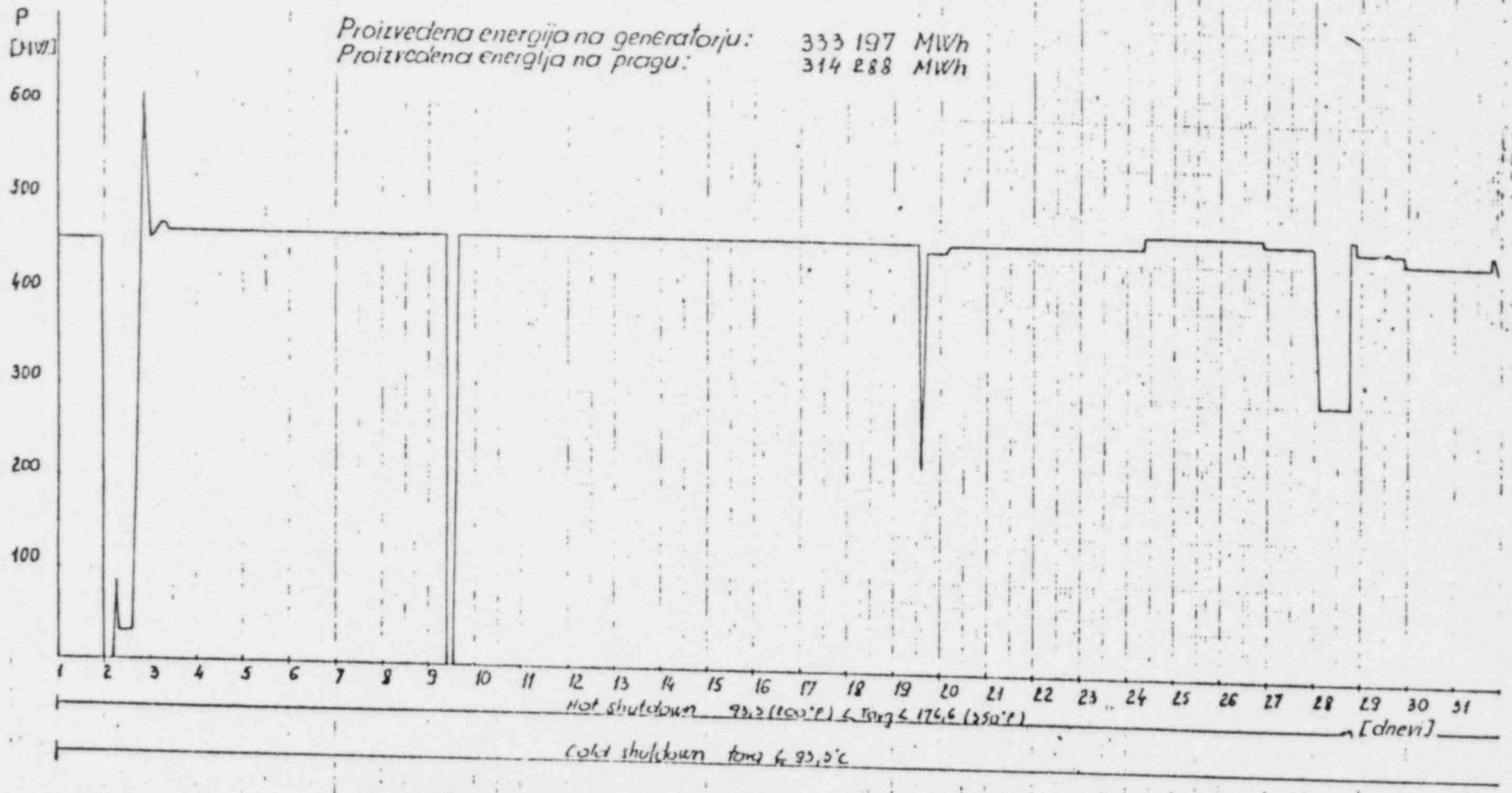
LEGENDA:

1 - CSD
2 - ZAČETEK HSD
3 - KONEC SI
4 - REAKTOR KRITIČEN
5 - IONIZACIJA

MARCH 82

DIAGRAM OBRATOVANJA NE KRŠKO za mesec Marec 1982

Proizvedena energija na generatorju: 333 197 MWh
Proizvedena energija na pragu: 314 288 MWh



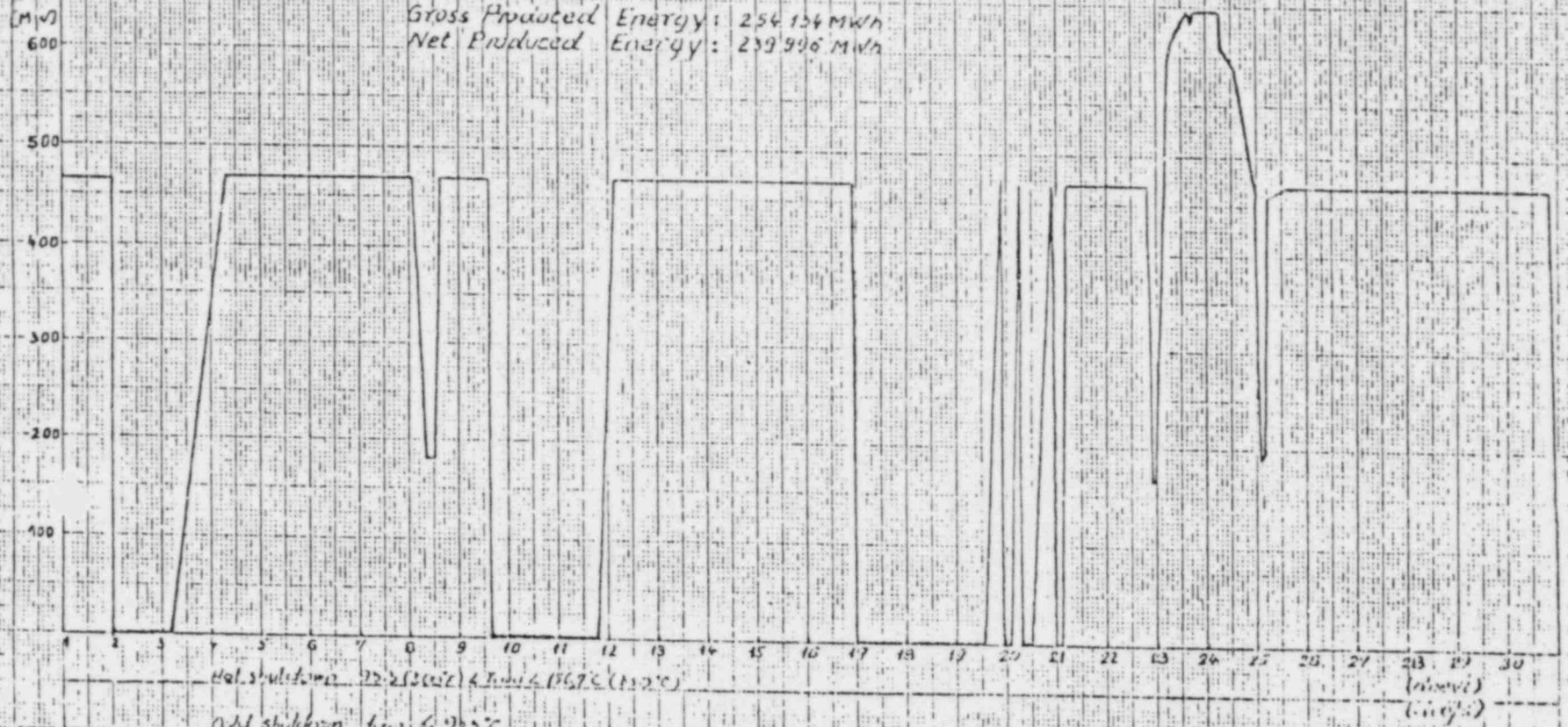
APRIL, 82

DIAGRAM OBRATOVANJA NE KRŠKO za mesec april 1982

NE KRŠKO OPERATING DIAGRAM for April, 1982

Proizvedena energija na generatorju: 254 134 MWh
Proizvedena energija na pragu: 239 996 MWh

Gross Produced Energy: 254 134 MWh
Net Produced Energy: 239 996 MWh

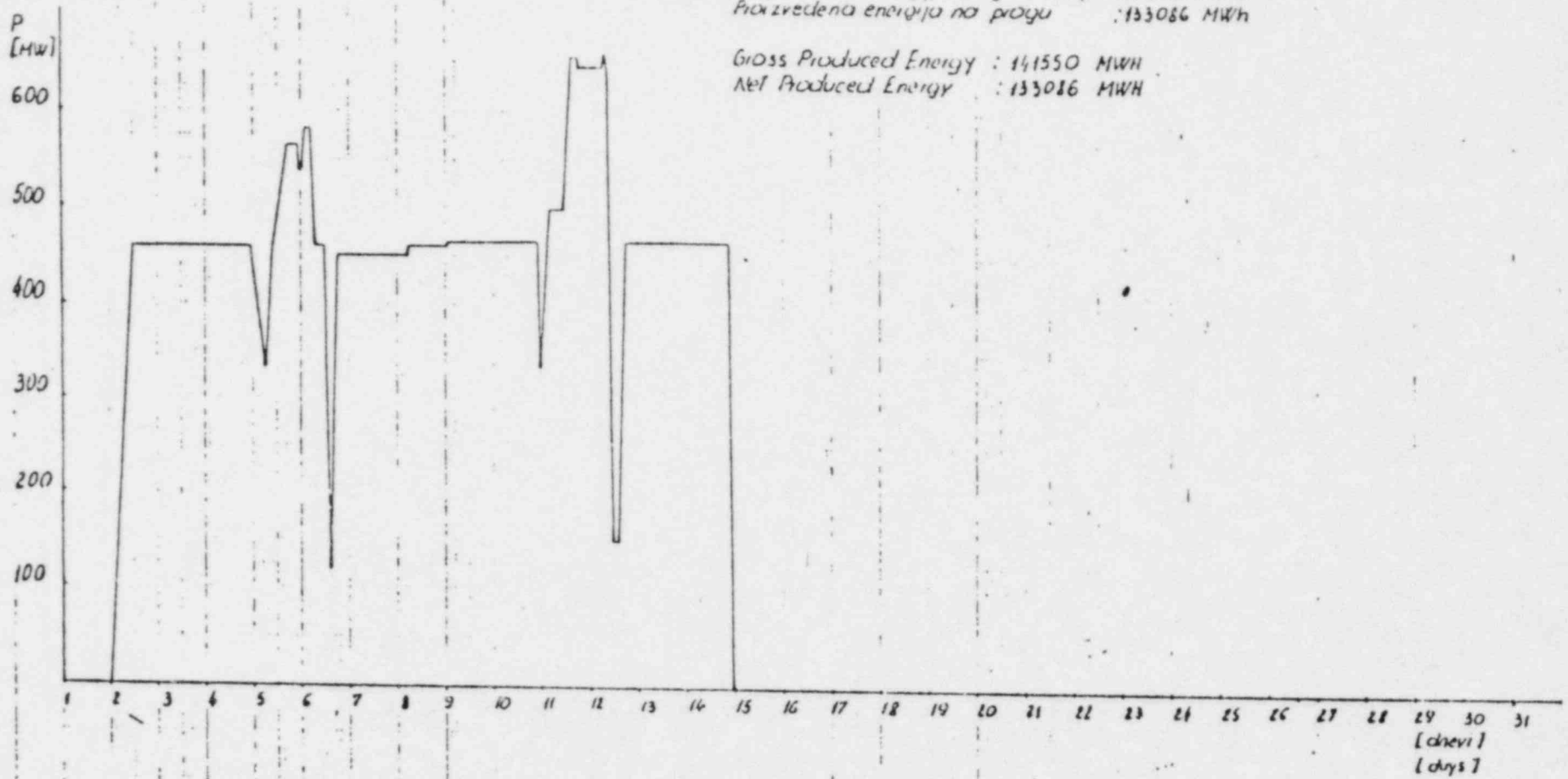


MAY, 82

DIAGRAM OBRATOVANJA NE KRŠKO za mesec MAJ 1982
NPP KRŠKO OPERATING DIAGRAM for MAY, 1982

Proizvedena energija na generatorju : 141550 MWh
Proizvedena energija na pragu : 133086 MWh

Gross Produced Energy : 141550 MWH
Net Produced Energy : 133086 MWH



APPENDIX IV. - List of Participants in discussions with the IAEA Mission

J. Aralica	Technical Director, Operation	NEK
N. Bernot		IBE
P. Bilcar	Superintendent, Erections	NEK
V. Bradac		IE
J. Brgulian	Manager, Quality Assurance	NEK
M. Copic	Chairman, Advisory Board of Reactor Safety	RKE SRS RKE SRS
I. Durdek	Chief of QA/QC Engineering	NEK
A. Fabijancic	Planning and Scheduling Department	NEK
V. Fatur		RKE SRS
D. Feretic	Technical Director	NEK

D.G. Fitzgerald	Vice-President Intern.Operations	NUS
M. Gregoric		IJS
D. Horwat	QA Consultant	IMK
V. Janoschek		UNSD
M. Jeran		IBE
P.V. Judd	Consultant	NUS
B. Mavko	Coordinator, Nuclear Safety	IJS
Z. Pavlovic	Manager, Licensing and design	NEK
D. Tankosic		NEK
P. Tomas		IRB
J. Valcic		RKEIRZ SRH
B. Vojnovic		IRB

Westinghouse attendees at presention (1982-06-09)

J. Alba	Nuclear Technology Division - Systems Engineering
E.M. Burns	Nuclear Technology Division - Nuclear Safety & Licensing
D. Consoletti	
E. Heggeseth	
J. James	
J.V. McKeown	Project Director, Krsko Project
W. Revler	
N.R. Singleton	Nuclear Technology Division