ISTC Project #3345

Source Term Assessment at Ex-vessel Stage of Severe Accident

Technology Implementation Plan

on the work performed from 01.01.2007 to 31.12.2007

Federal State Unitary Enterprise "St.Petersburg Research and Design Institute ATOMENERGOPROEKT"
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PLAN FOR TECHNOLOGY APPLICATION

1. What market-value results have been achieved or are expected?

The project purpose is decrease of estimation uncertainties for emergency releases during severe accident at NPP with VVER. For this the experiments on studying of fission product (FP) release from the molten pool at ex-vessel stage, FP transport in primary circuit, and chemical-physical iodine behaviour at chemical stage of accident have been carried out. Numerical models were proposed.

The results of experiments allowed to increase of estimations accuracy for platinum metals releases (Ru,Mo and so on) and aerosol releases into atmosphere. It was found out that the marked amount of aerosol may deposit in steam generator tubes. The experiments allowed to estimate partition coefficient of iodine volatile forms.

Obtained results can be used in data bases for numerical codes containing information about:

- FP releases from the molten corium;
- FP aerosol deposition and resuspension;
- Influence of sludge on iodine chemistry;

We hope that these results can improve numerical models used for safety proving of operating and new NPP with VVER.

№	Applicable results	Intellectual property	Owner	Possible application
1	Uncertainty analysis results of accident releases during severe accident.	Copyright	SP AEP	Obtaining of more accurate estimations of releases.
2	Experimental investigations of platinum metals releases from the molten pool. Estimation of release rate of corium components (uranium and zirconium oxides and others) and investigation of aerosol particle morphology.	Copyright	NITI, SP AEP	Obtaining of more accurate thermodynamic models.
3	Calculation of FP release from the molten pool.	Copyright	IBRAE, SP AEP	Obtaining of more accurate estimations of releases.
4	Experimental data on aerosol deposition and resuspension in the tube.	Copyright	NPO CKTI, SP AEP	Verification of deposition and resuspension numerical models.
5	Dynamic model for calculation of aerosol deposition and resuspension taking into account arbitrary particle size distribution and multi-layer deposit.	Copyright	SP AEP, IBRAE	Obtaining of more accurate estimations of FP releases into containment.
6	Experimental investigations of influence of temperature, ferric hydroxide sludge and water	Copyright	VNIPIET	Numerical code data base update. Verification of iodine

	presence on iodine volatility.			models.
7	The model for prediction of iodine behavior in the containment during chemical stage of severe accident.	Copyright	VNIPIET, SP AEP	Obtaining of more accurate estimations of volatile iodine releases at presence of corrosion products.

A) What tasks should be solved for the results to meet the requirements of basic TCO? When and within what timeframe it will be implemented? Current stage of the project results utilization

To make project results meet the requirements of TCO it is necessary:

- Publication of project results.
- Maintain and broaden exchanges with potential TCO and collaborators (continuously).
- Determine issues, which require additional investigation, for new ISTC projects and for new partner agreements (2008).

The above-mentioned directions can be specified as follows.

Current status of project results utilization

Development stage	Results (numbered 1-7 in accordance with p.1)
Finalization of publications	1, 7
Scientific and technical researches on NPP-2006 for construction project LAES-2 for the period 2007-2009 years.	1-7

Final list of deliverables

№	Document	Confidentiality	Title
1	Report	Non-classified	Analysis of calculation results for severe accident scenarios.
2	Report	Non-classified	Experimental studies of the low-volatile fission products release at the oxidation of suboxidized molten corium.
3	Report	Non-classified	Analytical investigation of fission products release from molten pool or core catcher.
4	Report	Non-classified	Experimental study of aerosols transport processes in the primary circuit equipment.
5	Report	Non-classified	Theoretical and computer modeling

			of aerosol transport in the primary circuit.
6	Report	Non-classified	Experimental investigations of containment parameters impact on volatile iodine content and correlation.
7	Report	Non-classified	Numerical and theoretical modeling of containment parameters impact on volatile iodine species content and correlation.

B) What is the status of intellectual property on results?

Intellectual property rights	Territories, application and patent numbers	Previous (BP) or derivative (FP) rights
Copyright	Territories of parties funding the Project	
Commercial rights	Territories of parties not funding the Project	

C) Rough schedule of the project results introduction

Activities on the utilization of results	Invited partners	Schedule of work	Evaluation of future expenditures
Scientific and technical researches on NPP-2006 for construction project LAES-2 for the period 2007-2009 years.	IBRAE, VNIPIET, NITI	Proposal has been examined by Rosatom	Proposed budget of the project $3000000

Plan for involving TCO into the promotion of results

- Continuous cooperation with collaborators in the framework of projects carried out by the research team.
- Participation in international conferences and seminars.
- Establishing contacts with foreign researchers, companies and research centers working in the field of severe accident studies.
- Studying of international programs on severe accident investigations and making the proposals on experimental investigations within these programs.

Project collaborators

Foreign project collaborators are:

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Project participants attended the following international conferences and meetings:

1. CEG-SAM Meeting, 12 February 2004 г, Paris, France.
2. CEG-SAM Meeting, 6 March 2007 г, Dresden, Germany.
3. EVAN Steering Committee Meeting, 7 September 2007 г, St. Petersburg, Russia.
4. CEG-SAM Meeting, 9 September 2007 г, St. Petersburg, Russia.
5. Conference ICAPP'07, 13-18 May 2007 г, Nice, France.
6. EVAN Steering Committee Meeting, 5 March 2008 г, Budapest, Hungry.
7. CEG-SAM Meeting, 6 March 2008 г, Budapest, Hungry.

Cooperation with collaborators

The Project was implemented in close cooperation with collaborators, including the following activities:

- detailed discussion of the experimental matrix and update of the Work Plan;
- analysis and evaluation of results of phase diagram studies;
- determination of experimental program priority;
- agreed composition of each planned experiment, specification of its procedure and posttest physicochemical analysis;

- preparation of a proposal for a further development of the Project.

Collaborators received all deliverable materials prepared during the Project implementation.

Discussion of the Project and its results was arranged at joint meetings and by e-mail. 2 meetings were organized in the course of the Project implementation.

Beside presentations at meetings with collaborators the Project participants made presentations at 4 meetings of the Contact expert group CEG-SAM.

Contacts with foreign researchers, companies and institutes

Participation in international conferences and meetings, publication of papers and presentations, recommendations of collaborators on the Project enabled to establish productive exchanges with leading researchers of severe accident issues. Including:

Ari Auvinen (VTT Technical Research Centre of Finland, Finland), Hans-Josef Allelein (Gesellschaft fur Anlagenund Reaktorsicherheit (GRS) mbH, Germany), Paul David Bottomley (Institut fur Transurane (ITU), Germany), Salih Guentay (Paul Scherrer Institut, Switzerland), Bernard Clement (IRSN, France), Herve Chalaye (CEA-DEN, France), Herranz Puebla Luis Enrique (CIEMAT, Spain).

Valuable discussions with foreign partners and our experience in experimental investigations may be used in preparing of ISTC projects and proposals for foreign partners.

Acquaintance with international programs

Studying of foreign programs on investigation of severe accidents (SARNET, SARNET-2) helped us (with collaborators support) to prepare a proposal on future cooperation in experimental work and modeling work.

a) Do you have all necessary facilities to continue work as a team after the Project completion?

Yes

b) What additional services can be granted by the ISTC in order to reach the set goals?

Assistance in the TCO identification

Manager of Project # 3345, Doctor.

V.V. Bezlepkin