

MINISTRY OF ENERGY OF THE REPUBLIC OF BELARUS

BELNIPIENERGOPROM

DESIGN SCIENTIFIC AND RESEARCH REPUBLICAN UNITARY ENTERPRISE

**VALIDATION OF INVESTMENTS IN THE NUCLEAR POWER PLANT
CONSTRUCTION IN THE REPUBLIC OF BELARUS**

BOOK 11

ENVIRONMENTAL IMPACT ASSESSMENT

1588-ПЗ-ОИ4

PART 8

EIA REPORT

Part 8.1. NPP Description

EXPLANATORY NOTE

(06.07.2010 version)

Director

Rykov A. N.

Deputy Director

Bobrov V. V.

Chief Project Engineer

Strelkov A. I.

2010

Contents

Code	Description	Page
1588–ПЗ–ОИ4 Part 8.1	1 Terms and definitions	9
	2 Introduction	32
	3 General. NPP construction necessity validation	35
	3.1 Information on the documents providing the grounds for the construction of the Belarusian NPP	35
	3.2 Basic normative documents regulating the activities in the field of the nuclear energy in the Republic of Belarus	36
	3.3 Brief information about the organizations that have requested, designed and prepared the EIA	36
	3.4 Technical and economic backgrounds for the development of nuclear power industry in Belarus	38
	3.5 Fuel and energy balance of the Republic of Belarus till 2020	39
	4 Alternative NPP sites. Alternative energy sources	43
	4.1 Alternative sites for NPP construction	43
	4.2 Alternative electric energy sources	55
	4.3 Comparative characteristics of different types of fuel, TPS and NPP	56
	4.4 Description of alternates	58
	5 Possible alternatives of implementation of design solution	60
	5.1 Pressurized water reactor (PWR)	62
	5.2 Boiling water reactor (BWR)	63

Code	Description	Page
	5.3 Pressurized heavy water reactor (CANDU)	64
	5.4 Comparison of reactor types by the main parameters	65
	6 Description of the NPP. technological systems and technical solutions	68
	6.1 Main technical and economic characteristics of NPP-2006	68
	6.2 Information on the trends and current new-situation in the development of the generation Russian NPP projects	70
	6.3 Information about expert conclusions of the international contests	71
	6.4 Description of analogue NPP project analogue and main project characteristics	73
	6.4.1 Source and purposes of the project	73
	6.4.2 Description of the project	75
	6.5 NPP functional layout. Main equipment components	76
1588–ПЗ–ОИ4 Part 8.1	6.5.1 NPP functional layout	76
	6.5.2 Main NPP equipment components	78
	6.6 Arrangement of reactor installation equipment	81
	6.6.1 Reactor	81
	6.6.2 Core	84
	6.6.3 Drives	94

Code	Description	Page
	6.6.4 Steam generator	94
	6.6.5 Main circulating pumping aggregate (MCPA)	96
	6.6.6 Reference of the turbine plant main equipment	97
	6.7 Main criteria and principles of safety	99
	6.7.1 Safety criteria and design limits	99
	6.7.2 Purposes of providing radiation safety	101
	6.7.3 Basic principles and project foundation of safety systems	102
	6.7.4 Principle of deep echeloning of the protection	104
	6.8 Safety systems. Project principles and project solutions	106
	6.8.1 Melt localization system	112
	6.8.2 Sealed barriers system (containment)	113
	6.8.3 Reference of safety systems and equipment used in NPP project	114
	6.8.4 Main results of safety system use	115
	6.9 General plan	118
	7 Characteristics of Belarusian NPP sources of impact on the environment	122
	7.1 Nuclear plant construction	123
	7.2 Brief description of types of NPP impacts on the environment	126

Code	Description	Page
	7.3 Physical and chemical impacts	129
	7.3.1 Heat impact	129
	7.3.2 Chemical impact	131
	7.3.3 Liquid output into the environment	133
	7.3.4 Characteristics of chemical outputs	135
	7.4 Radiation impact	136
	7.4.1 Outputs of radioactive gases and aerosols	136
	from the station	
	7.4.2 Dumping of radioactive substances from	136
	NPP	
	7.5 Radioactive waste disposal	139
	7.5.1 Sources of RW forming	140
	7.5.2 Solid RW	141
	7.5.3 Liquid RW	141
	7.5.4 Gas and aerosol waste	142
	7.5.5 Storage of solid radioactive waste	144
	7.6 Impact and estimate of noise, electric field, oil	144
	equipment influence	
	7.6.1 Impact and estimate of noise influence	144
	7.6.2 Impact of electric field and its estimate	146
	7.6.3 Impact of oil-filled equipment and its	147
	estimate	
	8 Nuclear fuel handling	148
	9 Radiation protection	151
	9.1 Radiation safety control	151

Code	Description	Page
	9.2 Main criteria and radiation safety limits	151
	9.3 Main measures of providing radiation safety	152
	9.4 Project foundations and main project approaches to radiation safety	153
	9.5 Validation of NPP radiation safety	154
	10 NPP decommissioning	155
	10.1 Conceptual approach to the problem of NPP decommissioning	155
	10.2 Environmental safety of energy unit at disposal	157
	11 Radiological protection of population and environment	158
	11.1 NPP operation in normal operation conditions and disturbances of normal operation	158
	11.2 Radiation consequences of accidents on energy units.	160
	11.2.1 International nuclear events scale (INES)	160
	11.2.2 Referent heavy beyond design basis accident	162
	11.2.3 Radiation consequences of the beyond design basis accident	164
	11.2.4 Radiation control. General	165
	12 Summary	166