PROJECT	ПРОЕКТ
SHELTER IMPLEMENTATION PLAN (SIP) NEW SAFE CONFINEMENT DESIGN, CONSTRUCTION AND COMMISSIONING CONTRACT N° SIP08-1-001	**ПЛАН ОСУЩЕСТВЛЕНИЯ МЕРОПРИЯТИЙ (ПОМ) НОВЫЙ БЕЗОПАСНЫЙ КОНФАЙНМЕНТ КОНТРАКТ НА ПРОЕКТИРОВАНИЕ, СТРОИТЕЛЬСТВО И ВВОД В ЭКСПЛУАТАЦИЮ № SIP08-1-001**
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THE STATE SPECIALIZED ENTERPRISE "CHERNOBYL NPP"	ГОСУДАРСТВЕННОЕ СПЕЦИАЛИЗИРОВАННОЕ ПРЕДПРИЯТИЕ "ЧЕРНОБЫЛЬСКАЯ АЭС"
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Project Name / Наименование проекта			Originator / Автор	Sub-division / автор или подразде ление		SIP Task / Задача ПОМ		Task Breakdown Code / Шифр позадачной разбивки					Type of Document / Тип документа			Serial Number / Серийный номер документа			Revision / Редакция	
S	I	P	N	L	I	2	2	A	5	0	0	_	C	D	S	0	0	1	0	1

Systems, Structures & Components Important to Safety	Systems, Structures & Components Not Important to Safety	Системы, конструкции, и компоненты, важные для безопасности	Системы, конструкции, и компоненты, не важные для безопасности

DOCUMENT TITLE	НАЗВАНИЕ ДОКУМЕНТА
NSC CS-1 CONCEPT DESIGN SAFETY DOCUMENT CHAPTER 2 – SYSTEMATIZED DESIGN CRITERIA & REQUIREMENTS	**ДОКУМЕНТ ПО БЕЗОПАСНОСТИ В РАМКАХ КОНЦЕПЦИИ ПРОЕКТА ПК-1 НБК ГЛАВА 2 : СИСТЕМАТИЗИРОВАННЫЕ ПРОЕКТНЫЕ КРИТЕРИИ И ТРЕБОВАНИЯ**

ENGLISH VERSION	~~RUSSIAN VERSION~~	АНГЛИЙСКАЯ ВЕРСИЯ	~~РУССКАЯ ВЕРСИЯ~~

Rev. / Ред.	Date / Дата	Prepared / Подготовил	Checked / Проверил	Status / Статус	Reason for Revision / Причины изменения	Approved / Утвердил
01	2008-12-04	SPO / NSH	PMI	PRE	Overhauling following comments from SIP-PMU, KSK and RA	MHR
00	2008-07-04	GMA	PMI	PRE	First issue	MHR

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ADL	Acceptable Design Level
AFAS	Automatic Fire Alarm System
AFES	Automatic Fire Extinguishing System
AFF	Automated Fire Fighting device
AFWS&E	Automatic Fire Warning System and Evacuation
AHU	Air Handling Unit
ALARA	As Low As Reasonably Achievable
ASB	Administrative & Servicing Building
ASRU	Auxiliary System of the Reactor Unit
BDES	Back-up Diesel Electrical Station
BSA	Baltic Scale of Altitude
CB-3	Common Building – 3
CLPS	Cooling Lake Pumping Station
CCP	Central Control Panel
CD	Conceptual Design
CDF	Closed Distribution Device
CDSD	NSC CS-1 Concept Design Safety Document
CE	Critical Event
CF	Core Fragments
CF-1430	Changing Facility 1430
CFD	Computational Fluid Dynamics
CH	Central Hall
ChNPP	Chernobyl NPP
CIE	Central Intermediary Events
CMU	Cabinet Ministers of Ukraine
COP	Construction Organisation Plan
CP	Check Point
CPT	Cone Penetration Test
CS-1	First Commissioning Stage
CS-2	Second Commissioning Stage
CS-3	Third Commissioning Stage
DBE	Design Basis Earthquake
DC	Design Criteria
DCR	Design Criteria and Requirements
DP	Design Packages
DS	Deaerator Stack

DSS	Dust Suppression System
EBP-A, B	Early Biddable Project, Packages A and B
EBRD	European Bank for Reconstruction and Development
EDR	Exposure Dose Rate
EGE	Engineering & Geological Elements
EIA	Environmental Impact Assessment
EO	Expert Organisations
EN	Explanatory Note
FAS	Fire Alarm System
FCM	Fuel Containing Material
FDS	Fire Dynamics Simulator
FS	Feasibility Study
GWL	Ground Water Level
HLW	High-Level Waste
HVAC	Heating, Ventilation and Air Conditioning
IAEA	International Atomic Energy Agency
IAG	International Advisory Group
IAMS	Integrated Automated Monitoring System
ICS	Integrated Control System
ICSRM	Industrial Complex for Slid Radwaste management
IDC	Inter-Disciplinary Check
IE	Initial Event
IFT	Invitations For Tender
IHP	Industrial Heating Plant
ILW	Intermediate-level Waste
IMS	Information Measurement System
IMSM	Integrated Management Systems Manual
IS	Ionizing Source
ISDB	Integrated Shelter Database
ISF	Interim Storage Facility
ISF-2	Interim Storage Facility - 2
ISO	International Organization for Standardization
ISP NPP	Institute for Safety Problems of NPP
IWD	Identified Working Designs
KIEP	Kiev Institute Energoproekt
LANL	Los Alamos National Laboratory
LFCM	Lava-like Fuel-containing Materials
LLW	Low-Level Waste

LP	Labour Protection
LPE	Limitation of Potential Exposure
LPP	Labour Protection Program
LRTP	Liquid Radwaste Treatment Plant
LRW	Liquid Radioactive Waste
LS	Localising Structure
LSWS	Liquid & Solid Waste Storage
LWS	Liquid Waste Storage
LZ	Local Zone
MDE	Maximum Design Earthquake
MDSS	Modernized Dust Suppression System
MHU	Ministry of Health of Ukraine
MLW/LLW – LL	Medium and Low Level Long-Lived Waste
MS	Monitoring System
NAEK	National Atomic Energy Generating Company “Energoatom” of the Ministry of Fuel and Energy of Ukraine
ND	Normative Documents
NIS	No Impact on Safety
NIISK	Research Institute of Building Structures
NLA	Normative Legislative Acts
NLD	Normative & Legal Documents
NPP	Nuclear Power Plant
NRS	Nuclear and Radiation Safety
NSC	New Safe Confinement
NVS	New Ventilation Stack
OS	Chernobyl NPP Object Shelter
OSPU	General Sanitary Rules for Radiation Safety of Ukraine
P	Probability
PER	Potential Exposure Restriction
PL	Permissible Limit
PLC	Programmable Logical Controller
PMU	Project Management Unit
PM	Process Materials
PPE	Personal Protective Equipment
PPS	Physical Protection System
PuSO	Special (Transport) Treatment Point
RA	Regulatory Authorities
RAW	Radioactive Waste
RDAS	Reactor Department Auxiliary Systems

RIPM	Respiratory Individual Protection Means
RM	Radiological Monitoring
RMS	Radiation Monitoring System
RS	Radiation Safety
SACS	State Architecture and Construction Supervisory (inspection body)
SAO	Standard Access Order (for implementation work)
SAR	Safety Analysis Report
SAS	Sanitary Accommodation Space
SCR	Sanitary Compliance Report
SFMS	Structures & Foundation Monitoring System
SIP	Shelter Implementation Plan
SLRAW	Short-Lived Radioactive Waste
SMS	Seismic Monitoring System
SNF	Spent Nuclear Fuel
SNRC	State Nuclear Regulatory Committee of Ukraine
SPS	Sewage Pumping Station
SPZ	Sanitary Protected Zone
SRAW	Solid Radioactive Waste
SRS	Safety Related System
SRAWS	Solid Radioactive Waste Storage
SSC	Systems, Structures & Components
SSC IS	Systems, Structures & Components Important to Safety
SSCR	Self-sustained Chain Reaction
SSE ChNPP	State Specialized Enterprise ChNPP
SSTC NRS	State Scientific and Technical Centre for Nuclear and Radiation Safety
TD	Technical Decision
TR	Technical Requirement
TUE	Transuranium Elements
TV	Television
UAB	Unified Administrative Building
UCP	Unit Control Panel
UDO	Ukrainian Design Authority
UPS	Uninterruptible Power Supply
VS	Ventilation Stack
VS-2	Ventilation Stack 2
WD	Working Design
WEP	Work Execution Plan
WP	Work Place

2.1 GENERAL PROVISIONS

The purpose of this chapter is to provide the design basis for the NSC Detailed Design (Design + Working Documentation) of the New Safe Confinement first Commissioning Stage (NSC CS-1), which includes design criteria and requirements (DCR).

The definition of design criteria and requirements (DCR) for the NSC CS-1 as listed in this chapter is based on the set of DCR from the NSC Feasibility Study (Conceptual Design) NSC FS (CD) [1.12.8].

Additionally the following was taken into account:

- Remarks and comments of the Regulatory Authorities on the NSC FS (CD) [1.12.18];
- Documents containing the design normative requirements, developed especially for the NSC;
- Modifications to the Ukrainian regulatory base;
- Input data, obtained from ChNPP after the NSC FS (CD) development;
- Additional documents produced by ChNPP since the NSC FS (CD);
- Result of interfaces within the frame of the general coordination between RA, ChNPP and NOVARKA;
- Additional proposals made by NOVARKA to resolve shortcomings revealed in the result of gained experience.

As stated above, the Design criteria and requirements are based on safety laws, norms, codes and standards. The DCR, presented in this chapter in Attachment 2.1, including lists of applicable laws, norms, codes and standards, are basically sufficient to develop the NSC CS-1 Detail Design. In the process of Detail Design development of the following will be defined:

- Criteria which are absent from the available documents by additional research and/or mock-up tests;
- On the basis of list of norms, codes and standards in Attachment 2.1, the criteria and the requirements for:
  - Structure of the equipment, pipelines and industrial cabinets for equipment;
  - Arrangement of cable lines;
  - Protection of systems and equipment from unauthorized access;
  - Technical diagnosis;
  - Software and its verification;
  - Metrological maintenance;
  - Tests.

Chapter 4 provides the schedule of definition and concurrence of the abovementioned design criteria and requirements with the Regulator. The development of technical decisions for the NSC CS-1 systems and structures will take into account the potential interfaces with:

- The existing systems and structures of the Object Shelter;
- Their current upgrading activities;
- The stabilization of the existing structures undertaken as part of the SIP program.

Also, the mutual dependence of CS-1 facilities with the facilities to be erected and works to be performed at the subsequent stages of NSC construction, commissioning and operation will be taken into account. Section 2.4.7 presents the associated design criteria and requirements as well as interfaces with further commissioning stages.

Additional restrictions and requirements, along with the input data for designing, are included in Chapter 3 of this document.

These design criteria and requirements shall be developed (detailed) during the design process and can be submitted for concurrence with the Regulatory Agencies both before the CS-1 Design submission for review and as a part of the NSC CS-1 Design.

2.2 NORMS AND STANDARDS

The NSC CS-1 and all auxiliary facilities will be designed in accordance with the technical requirements of the applicable effective codes, regulations, and standards of Ukraine. Any other codes, regulations and standards with similar or higher requirements than the appropriate Ukrainian codes and standards will be applied on occasions, subject to the compliance procedure specified in Section 4.2.5.

2.2.1 LIST OF NORMS AND STANDARDS

Attachment A2.1 contains a list of major effective Ukrainian normative and legislative acts (NLA) and normative documents (ND) that will be used during the Detail Design Development of NSC CS-1 in the following areas:

- Radiation and nuclear safety;
- Industrial health and safety;
- Environmental safety;
- Fire Safety;
- Design, construction and operation of facilities for nuclear materials and RAW management;
- Design, construction and operation of industrial facilities;
- Physical protection of facilities and control and accounting of nuclear materials.

The technical norms and standards will include documents of two major types:

- NLA and ND that are mandatory for the NSC CS-1 Design;
- ND, requirements of which are recommended in limited scope, because they are applicable to nuclear industry facilities and NPPs in particular.

The Shelter and NSC facility are not nuclear industry facilities or reactor units. However, criteria and requirements of the NLA and ND specific to nuclear industry facilities are presented in this document.

The Detail Design will use the DCR presented in this chapter. The separate types of DCR, lacking in this chapter, will be made specific during the design process (see Section 2.1) on the basis of NLA and ND, presented in Attachment 2.1. Design criteria and requirements will be specified further during Design. In case of any change of DCR and/or deviation from the NLA and ND for any technical reason, NOVARKA will provide the appropriate justifications and support to the Employer during the concurrence by the Regulatory Authorities of such modifications of DCR in accordance with the effective procedures.

2.2.2 APPROACH TO APPLYING BEST INTERNATIONAL REGULATIONS AND STANDARDS

This approach is presented in Section 4.2.5.

2.3 CRITERIA OF INITIAL EVENTS

2.3.1 EXTERNAL EVENTS RELATED TO NATURAL PHENOMENA

2.3.1.1 Seismic Impacts

The seismic hazard for this site mainly is connected to the influence of the seismic regions of the Romanian Carpathian Mountains (Vrancha Mountains – VRN –) and local – LOC – earthquakes from the Ukrainian Platform.

The NSC CS-1 shall comply with the requirements for Category I facilities for seismic resistance in accordance with [1.2.15]. Here the requirements [1.2.15] are applied to systems, structures and components (SSC) of NSC CS-1, depending on SSC classification on impact on nuclear and radiation safety as indicated in Section 2.6.3 of CDSD:

- SSC IS-1, as to SSC Category I Seismic Resistance;
- SSC IS-2, as to SSC Category II Seismic Resistance;
- SSC NIS, as to SSC Category III Seismic Resistance.

In accordance with [1.7.2], during the NSC CS-1 design the following main principles of seismic resistance will be realized:

- Structural systems of the facilities, foundations and NSC CS-1 base should not be damaged under Maximum Calculated Earthquake;
- NSC CS-1 SSC, not related to Category I facilities for seismic resistance, should be designed to resist earthquakes; here the criteria of radiation consequence limitations, indicated in Section 2.6.2 of CDSD are to be observed.

In addition to the main principles of seismic resistance assurance, the following will be necessary during design, construction and operation:

- Review of the secondary factors of damage, such as displacement of soil, fire, leakage of hazardous materials;
- Assessing of the spectra of reaction (floor-by-floor accelerograms) in places where the safety- related equipment will be installed and maintained;
- Provision of safety for workers, efficiency of SSC depending on their impact on NRS.

In accordance with [1.7.1] the earthquake intensity at the ChNPP Industrial Site constitutes:

- Design Basis Earthquake (DBE) - Magnitude 5, MSK-64 scale, DBE shall be based upon 100 years’ recurrence period;
- Maximum Design Earthquake (MDE) - Magnitude 6, MSK-64 scale. MDE shall be based upon a 10 000-year recurrence period.

For NSC CS-1 in accordance with [1.7.5, 1.7.7, 1.7.26, and 1.2.15] the following will be performed:

- From the 3 accelerograms (Full, VRN and LOC, see Section 2.4.7) for the Chernobyl Site given in [3.30] and in “Main normative requirements and design characteristics of earthquakes for the ChNPP site, May 2005’’, NOVARKA has calculated the response spectra. The following pages show these response spectra for 5% damping factor. On the same graphs, it is shown the MDE response spectra for ChNPP site (named below ‘’ChNPP

response spectra'' for ease of understanding) given in [3.30] and in table 2-3-1, for comparison.

- Then a dynamic modal analysis will be performed using spectral response given in document "Main normative requirements and design characteristics of earthquakes for the ChNPP site" on 3D model, including Arch & Foundation & soil interaction. The maximum responses for each mode are combined using the Complete Quadratic Combination, to obtain the seismic response for each earthquake direction. This approach will be used by NOVARKA to assess the seismic resistance of NSC CS-1 SSC;

The seismic calculation of the structure (steel arc/foundations) will be achieved considering a linear behaviour for the 3D model. Indeed, NOVARKA has checked at preliminary design (design stage 1) that no bearing uplift occurs under seismic combination and that the steel stress under seismic load combinations can be checked considering an elastic linear steel behaviour, limiting the max stress below yield stress. This will be confirmed and submitted for concurrence during design stage.

Considering thus that the seismic calculation is a linear one, and that the increased response spectra is envelop of the 3 time histories, NOVARKA considers the 3D dynamic spectral analysis as acceptable.

NOVARKA will also perform, in parallel to the dynamic modal spectral calculation described above, direct time histories calculation using the 3 sets of accelerograms provided by the Employer. These direct time histories calculation will allow for validating the dynamic modal spectral calculation during the Design, and in particular to :

- Get the time histories (accelerations) at main crane supports for the telescopic mast;
- Check the maximal seismic displacement of the steel arch at the connection with existing or new building (sizing of the expansion joints);
- Check maximal accelerations at selected points;
- Checking stresses in the most critical members of the steel arch (according to the dynamic modal spectral analysis);
- Check the foundations seismic loads.

To define the seismic resistance of any safety-related NSC CS-1 equipment according to [1.2.15], NOVARKA will determine the floor response spectra for all NSC CS-1 structural elevations on which that equipment is planned to be installed, using results of the dynamic modal spectral analysis previously described. Calculation of transferred spectra will be done using Floor Spectrum Generation method. For special equipment having a non linear behaviour under seismic actions (to be defined during detailed design stage), it will be used the results of the direct time histories calculation.

Requirements on provision of SSC stability to seismic impact depending on SSC influence on NRS are also given in section 2.6.3 of CDSD.

- Seismic resistance of NSC CS-1 Systems, Structures and Components (SSC) will be addressed at Design Phase in accordance with [1.12.19].
- Calculations for structures and foundations will be performed for basic and special combinations of loads taking into account seismic impacts according to requirements [1.7.5, 1.7.7, 1.7.26, 1.2.15 and 1.2.17].

Design basis characteristics of "response spectrum" for the Chernobyl NPP Industrial Site [1.7.2], which correspond to horizontal component of seismic impact, are given in table 2.3-1.

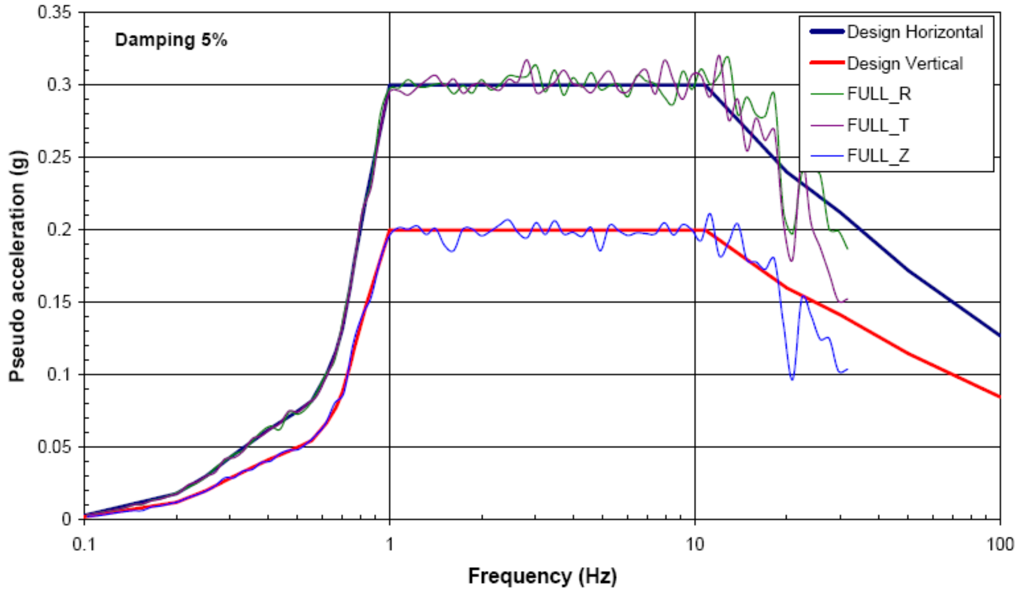
Table 2.3-1. Design basis characteristics of "response spectrum"

FREQUENCY, F (Hz)	PERIOD, T (s)	"SMOOTHED" SPECTRAL ACCELERATION, IN "g" PARTS
100.000	0.0100	0.127
50.000	0.0200	0.172
30.000	0.0333	0.212
20.000	0.0500	0.240
10.800	0.0926	0.300
5.000	0.2000	0.300
4.000	0.2500	0.300
3.333	0.3000	0.300
3.000	0.3333	0.300
1.000	1.0000	0.300
0.833	1.2000	0.220
0.769	1.3000	0.180
0.742	1.3480	0.160
0.700	1.4286	0.132
0.667	1.5000	0.116
0.675	1.4820	0.120
0.620	1.6120	0.100
0.556	1.8000	0.082
0.500	2.0000	0.075
0.400	2.5000	0.062
0.300	3.3333	0.043
0.250	4.0000	0.030
0.200	5.0000	0.018
0.100	10.0000	0.003
0.033	30.3030	0.000

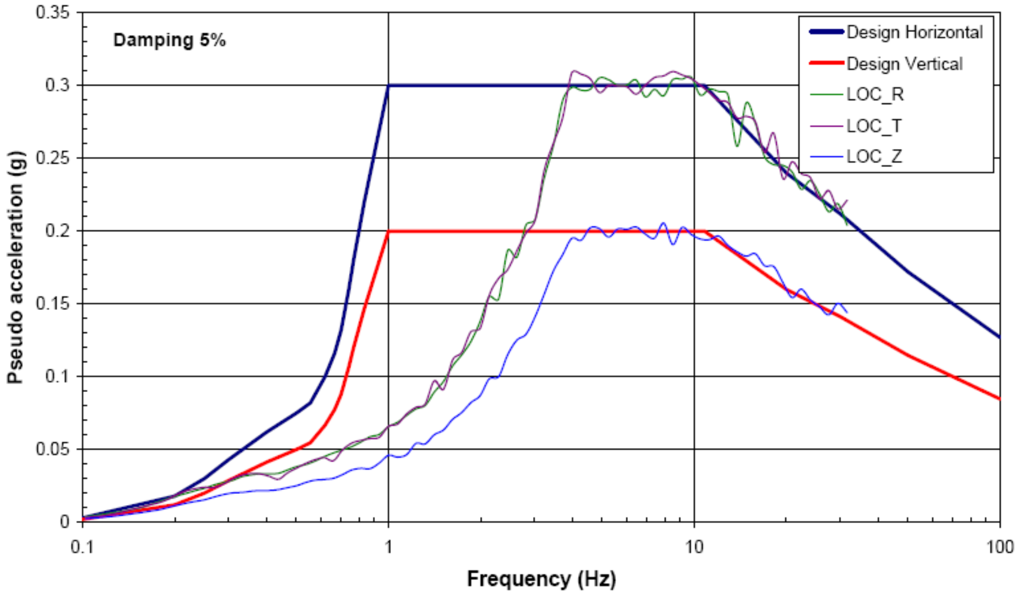
Vertical components of seismic oscillations (response spectrum) are accepted to be equal to 2/3 of the horizontal component of the oscillations [1.7.2].

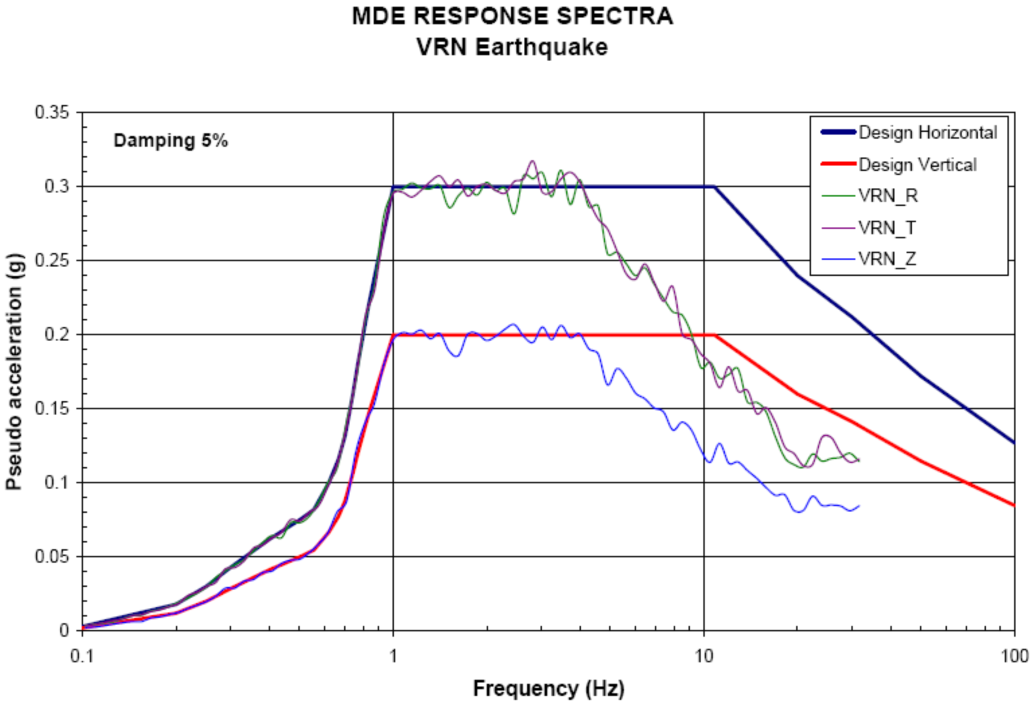
Spectral characteristics and maximal amplitudes of DBE acceleration shall be considered as 0.5 from corresponding values and amplitudes of accelerations for MDE [1.7.2]. The following figures present the full, LOC and VRN earthquake spectra.

MDE RESPONSE SPECTRA
FULL Earthquake



MDE RESPONSE SPECTRA
LOC Earthquake





2.3.1.2 Wind loads

According to requirements of [1.7.7] and [1.2.17] the following wind loads will be used. The below mentioned loads are applied to SSC NSC CS-1 depending on their classification according to impact on NRS:

- To SSC IS-1 load based on their extreme value with a recurrence period of 10 000 years;
- To SSC IS-2 load based on their maximum design value with a recurrence period of 100 years;
- To SSC NIS load based on their characteristic value with a recurrence period of 50 years.

	DBN V.1.2-2:2006		
	BASIC WIND		EXTREME WIND
Return Period	50 YEARS	100 YEARS	10000 YEARS
Speed (m/s)			
Wind Pressure q (kN/m^2)	0.45(1)		
Height Coefficient k or $C_e(Z)$			
z < 5 m	0.9		
z = 10 m	1.2(2)		
z = 20 m	1.55		
z = 40 m	2		
z = 60 m	2.25		
z = 80 m	2.45		
z = 110 m	2.66		

q(Z)			
z < 5 m	0.41		
z = 10 m	0.54		
z = 20 m	0.70		
z = 40 m	0.90		
z = 60 m	1.01		
z = 80 m	1.10		
z = 110 m	1.20		
Overloading Factor γ	1	1.14	1.6(3)
Q(Z) x γ			
z < 5m	0.41	0.46	0.656
z = 10 m	0.54	0.62	0.864
z = 20 m	0.70	0.80	1.12
z = 40 m	0.90	1.03	1.44
z = 60 m	1.01	1.15	1.616
z = 80 m	1.10	1.26	1.76
z = 110 m	1.20	1.36	1.92

(1) This value includes the gust factor

(2) This value includes the roughness factor

(3) The 1.6 safety factor is presented in Eurocode 2.1 Part 1.4 (wind load)

<u>Justification of 1.6 overloading factor:</u>

The extrapolation is based on Eurocode EN 1991-1-4: 2005

Reference speed V_{ref} in Eurocode is usually given for a 50 years return period (probability = 1/50=0.02). This refers to the 10 minutes mean wind velocity having the probability p of annual exceedance.

For a different return period with another p, the reference speed is given by Gumbel formula (§4.2 – Note 4, Eurocode):

$V_{ref}(p) = V_{ref} \times C_{prob}$

With Eurocode probability factor C_{prob} :

$$C_{prob} = \left[\frac{1 - K \times Ln(-Ln(1-p))}{1 - K \times Ln(-Ln\,0.98))} \right]^n$$

V_{ref} : Fifty years return period Eurocode reference wind velocity

K : Statistical shape adjustment parameter (depending on the coefficient of variation of extreme value distribution).

n : Exponent

$$q_{ref} = (1/2)\rho V^2_{ref}$$

Representative values for K and n :

- Eurocode 2000 and 2005 K =0.2; n =0.5

Numerical application for 10 000 years return period:

- Eurocode $V_{ref}(10\ 000\,years) = 1.26 \times V_{ref}$

Under pressure the safety factor will be 1.26^2 = 1.588 (≈ 1.60)

The 1.6 overloading factor applied on the fifty years return period loads corresponds to the actions of extrapolated 10000 years return period wind.

The distribution of wind loads based on the NSC CS-1 configuration will comply with the requirements of DBN V 1.2-2:2006 [1.7.7].

NOVARKA will perform wind tunnel tests on the scaled models of the structure. Dynamic amplification coefficients will be stated per the wind tunnel tests and included in the wind design loads for the structural analysis.

2.3.1.3 Snow loads

According to the requirements of [1.7.7] and [1.2.17], the following snow loads will be used. The below mentioned loads are applied to NSC CS-1 SSC depending on their classification according to impact on nuclear and radiation safety (NRS):

- To SSC IS-1 load based on their extreme value with a recurrence period of 10 000 years;
- To SSC IS-2 load based on their maximum design value with a recurrence period of 100 years;
- To SSC NIS load based on their characteristic value with a recurrence period of 50 years.

Characteristic Value of Snow Weight	1.59 (159) kPa (kgf/m^2) – for Snow around Pripyat area (on appendix E [1.7.7]),
Maximum design load (without factor C of item 8.6 [1.7.7])	1.813 (181.3) kPa (kgf/m^2),
Extreme load	2.10 (210) kPa (kgf/m2)
Load reliability factor	1.14 – for design load (item 8.11 [1.7.7]) (for a return period T=100 years)
Consideration of extreme load factor	1.31 of frequencies of recurrence once in 10000 years [1.2.17].

* The Load Factor 1.31: following Section 1.10 [1.2.17] the extreme load value is defined considering the available meteorological data for this region and accordingly indicated in 1.10 [1.2.17] extreme load factor is corrected.

The distribution of loads based on the NSC CS-1 structures configuration will comply with the requirements of Attachment 1, Scheme 3 [1.7.7].

NOVARKA will take into account the dynamic impact during snow and ice descent from NSC CS-1 roof. According to the NSC Licensing Plan, during the second phase of NSC Detail Design realization NOVARKA shall develop and submit for SSE ChNPP approval and RA concurrence the Criteria and Requirements (or model) of considerating of the dynamic impacts at snow and ice descent from the NSC roof (refer to Section 3.9.3.2 of CDSD).

2.3.1.4 Tornado

The tornado design characteristics for the confidence probability (P) for the element for the ChNPP [1.7.33] area, are presented in Table 2.3-2. With that, the below mentioned loads are applied to NSC CS-1 SSC IS-1.

Table 2.3-2. Tornado Design Characteristics

Tornado Design Characteristics	Value for Tornado $P=1{\cdot}10^{-5}$/y	Value for Tornado $P=1{\cdot}10^{-6}$/y
Design class of probable tornado, *kp*	1.5	3.0
Probability of exceedance (event/year)	$1{\cdot}10^{-5}$	$1{\cdot}10^{-6}$
Maximum vortex rotation speed, *Vp*, m/s	50	81
Tornado travel speed, *Up*, m/s	12.6	20.3
Pressure difference between the tornado vortex centre and periphery, ΔPp, hPa	31.0	81
Tornado path length, *Lp*, km	5.0	28.6
Tornado path width, *Wp,* km	0.05	0.29

According to section 2.6.3, it must be added that "SSC IS-1 should keep structural integrity, durability, and work capacity upon impacts of a class F1.5 tornado and partially (as required from beyond design basis analysis) upon impact of a class F3.0 tornado".

The tornado class 1.5 loads, the characteristics for which are set forth in Table 2.3-2, are to be considered as design loads.

As tornado 1.5 is considered a design basis event, the normal inspection measures will be implemented after such an event.

The tornado loads will be assessed as the entirety of the following:

- Wind pressure W that depends on the wind speed;
- Atmospheric pressure difference (air discharge) P between the tornado periphery and its centre.

The pulsating wind load component is to be assumed as equal to zero.

The wind pressure will be assessed, based on the guidance provided by [1.7.7] with precise aerodynamic coefficients, where the wind speed is assumed to be the maximum vortex rotation speed corresponding to the tornado design class.

For confined spaces, the loads from air discharge are to be fully taken into account. For fully open premises the inside and outside pressures become equal and there is no load from any air discharge.

The roof and sidewalls will be designed to withstand the impact of flying items resulting from a tornado occurrence based on the tornado class.

For design of NSC CS-1 structures the design class, Class 1.5, and its corresponding characteristics, will be used as the design basis criteria.

The impact of a tornado Class above 1.5 and lower than 3.0 will be addressed in the Design as a beyond design basis event provided with the following requirements:

1. **Criterion 1: The stability of the Arch foundation and the main load bearing members will be assured**

   In order to justify the implementation of this criterion, an approach based on a probabilistic calculation method will be applied to the main bearing structures and the purlins.

   This approach comprises the following steps:

   – Probabilistic assessment of the intensity of tornado impact on the NSC based on a mdel of space-dimensional distribution of wind and pressure in the tornado area (so called Rankin's model) which is described in IAEA Safety Guideline #50-SG-S11A. For this the characteristics of tornados on ChNPP site will be used. They arise from document SIP-PMU-195-D5-2-APP rev 2 dated 29.03.2002, namely Figure 2.4, Table 2.3 and 2.4 or more conservative properties. From this, the probability of tornadoes passing over the "elementary area (dimensions of the area are negiglbly small compared to the width of the tornado funnel) needs to be defined according to figure 2.4. Values of probabilities specified intables 2.3 and 2.4 are of indicatory nature, since the specified tables are intended for utilisation in deterministic calculations.

   – Impact on the surface at the critical points of the structure;

   – Probabilistic impact, pressure with surface impact;

   – Probabilistic assessment of the NSC facility stability;

   – Reliability analysis to calculate failure probability;

   – Comparison with the target probability (10^{-7} per year);

   – Clear interpretation and justification of the results obtained, in particular, explanations, when specifically and due to whih specific physical reasons failure occurs.

At the initial design stage NOVARKA will submit for the SSE ChNPP and Regulatory Agencies' concurrence detailed description and justification of the probabilistic method, which will be applied. In particular, a detailed description will be provided as well as justification of methodology contents for each of the above mentioned stages and procedures of the stages implementation as well as their interfaces.

2. **Criterion 2: The maximum values for flexure and displacement of the arch load-bearing members will not result in complete functional loss of the main lifting equipment.**

   Operational measures will restrict operation of the main cranes during weather conditions that could result in tornados (e.g. severe thunderstorms, etc). Otherwise, operational measures for the main cranes will provide with a minimal time of notification about tornado, required to move a crane into safe position. The time required to move the cranes back to a safe position will be estimated from the crane characteristics (quadrilatere translation speed) and the furthest distance to the safe position where they can be blocked. That safe position should be the western position, close to the maintenance garage, where radiations are supposed to be minimum. These issues (required time and safe position) will bedetailed taking into account the preliminary design of main crane and steel arch structure. It is paramount to consider the case when a crane should be loaded. In this case the required

time to safe position may also drastically increase when tornado is forecast. During the design, an analysis has to be done taking into account the duration to put down the load in safe position , to remove the sling, eg the maximum duration to release the crane from its duty, before being able to begin to move the crane back to its safe position and block it.

The garage safe position will prevent the fall down of crane components and the overstressing of the quadrilaterals under impact from the telescopic mast. In case of tornado occurrence, the lateral branches of the arches may go through plastic deformation, but this will not affect the main central part under which the main cranes are fixed. Each quadrilateral, if it is hanged to 3 rails as per initial conceptual design, will have a hinge in the middle to accommodate any imposed hyper static deflection coming from the main structure.

3. **Criterion 3: Maximum radioactive release**

NOVARKA proposes to prevent failure of the elementary cladding panels. The resistance would be obtained by increasing the capacity of the fixations on the purlins and performing ultimate tensile strength calculations for the outer skin of the outer cladding, under full Tornado Class 3 load.

The cladding integrity during tornado will avoid significant radioactive release from occurring.

Conservative assessment needs to be performed during the Design to determine:

- Radioactive dust spreading inside the NSC,
- Radioactive releases through untight areas of the NSC.

Dust release criteria are provided in section 2.6.1.3 of the CDSD.

4. **Criterion 4: Features and procedures to mitigate the consequences**

First of all, in order to mitigate radiation consequence, the measures will have to be performed:

- on identification of radiation conditions, especially, on surfaces contamination identification;
- on decontamination, first of all, of the most important areas;
- on identification of possible damages of the tight covering and simplified measures on temporary sealing.

After the early measures are performed, full scale decontamination may start as well as full scale maintenance and repair, at this:

- after the major event general condition of the facility will be assessed using monitoring systems and possible methods of external surveillance.
- examination and repair of the main facility will be performed via the access to the annular space using local biological protection in the repair areas.

Using inspection and maintenance platforms, damage to secondary structures (purlins and outer cladding) could be assessed. Some time later repair works would be performed with ad hoc robotised platforms installed on the same rails. They would be designed to allow repair operations under safe conditions for the workers." (Design by others).

2.3.1.5 Air Temperature

According to [1.7.7], the following air temperature values will be adopted in calculations. The below mentioned values are applied to SSC NSC CS-1 depending on their classification according to impact on NRS (see CDSD section 2.6.3):

Characteristic average daily temperature:	Minimum –20ºC,	Maximum +28ºC
Design Basis temperature:	Minimum –22°C	Maximum +31 °C
Overloading factor for limit values of temperature climatic actions	1.1	
Maximum Design Basis temperature	Calculating according requirement [1.7.7]	

Taking into account the requirements of [1.2.17], the maximum temperature difference (extreme temperatures) for a recurrence period of 10 000 years shall be as follows:

Maximum temperature difference:	Minimum -43ºC,	Maximum +45ºC

2.3.1.6 Lightning

The Design has provided for a lightning protection system developed in accordance with [1.3.23] and [1.4.11], including identification of the system features.

2.3.1.7 Under Flooding and Flooding

The maximum level of the underground water table corresponding to elevation +110.77 m will be adopted for NSC CS-1.

The relative ChNPP Unit 4 level 0.00 m corresponds to absolute level +114.00 m in the Baltic Scale of Altitude (BSA).

The relative NSC CS-1 level 0.00m was determined in the CD NSC (FS), taking into account the maximum level of the ground water to prevent the possibility of flooding of the NSC CS-1 structure by underground water, and corresponds to absolute level of + 118.00 in BSA. At the Design stage, based on the deep foundation and pile cap top selection results, the NSC CS-1 relative level of 0.00 m will be considered. Analysis will be carried out of buoyancy effects on deep foundations or other structures below elevation 110.77 m, as well as of possible flooding caused by pipelines or storm drains at the Design stage and, if necessary, mitigation measures will be addressed.

A site analysis will be performed to verify that increase of ground water level will be limited due to the level of the Pripyat River nearby.” “The maximum level will be used to verify buoyancy effects on deep foundations.”

2.3.1.8 Base Saturated Soil Liquefaction

Based on the conclusions of investigations, data of dynamic stability of saturated sandy soils [2.6.4] indicates the impossibility of soil liquefaction by seismic impact for Magnitude 7 MSK 64 scale. Consequently, consideration of seismic liquefaction of the soil layers supporting the NSC CS-1 structure is not required in the design.

2.3.1.9 Precipitation

At designing, the following will be considered [1.12.8]:

- The maximum precipitation observed in 20-minute period of the day once in a recurrence period of 100 years is 38 mm;
- The maximum precipitation observed in 24-hour period once in a recurrence period of 100 years is 105mm;
- The maximum precipitation for 20-minute period with recurrence interval of once in 10 000 years is estimated to be 72 mm;
- The maximum precipitation for 24 hours period once in a recurrence period of 10 000 years is 190 mm.

2.3.2 MAN-CAUSED EXTERNAL INITIAL EVENTS

2.3.2.1 Explosion

NSC CS-1 structures are designed without taking the impact of airblast from external explosion into account.

Design will contain the appropriate justifications, which will include the following:

- Analysis of potential hazard sources and values of impact from them on NSC CS-1 structures;
- Evaluation of NSC CS-1 external explosion hazards.

The appropriate organization and technical measures will be proposed as required in the Design and implemented by SSE ChNPP at ChNPP site and surrounding area in order to reduce the air shock wave to an extent lower than the extreme wind loads.

2.3.2.2 Aircraft Fall

Structures of NSC CS-1 are designed without considering impact from aircraft fall.

The NSC CS-1 Design (in particular, in SAR) will provide specific organisational and technical events, implemented in Exclusion Zone, excluding aircraft fall (including small). It is justified that probability of unintentional falls of aircrafts on NSC does not exceed $1 \cdot 10^{-7}$ /year. Realisation of this event is not the responsibility of NOVARKA.

2.3.2.3 External Fire

Based on the existing information on the sources of hazard, the Design shall provide for the following:

- Additional analysis of possible sources of hazard for the NSC and level of impact;
- Meeting of requirements of distances between the sources of the Fire Hazard and the NSC;
- Specific organizational and technical measures which SSE ChNPP implements at ChNPP site to reduce impact of external fire to acceptable level.

2.3.2.4 Initial Events Related to the Other ChNPP Facilities

The corresponding justifications will be performed in CS-1 Design to meet NLA and ND requirements for external impact, including:

- Analysis of possible emergency impacts at ChNPP facilities in terms of impact on NSC structures. Data on possible emergencies and levels of impacts are given in the Emergency Plan and Preparedness report of the Object Shelter;
- Justification for adequacy of made design solutions related to external impacts.

The Units 3 and 4 ventilation stack should be dismantled before sliding the NSC arch.

The Design shall study and justify the dismantling option of the existing Units 3 and 4 Ventilation Stack (VS), also taking into account the need for VS operation for Unit 3 decommissioning and VS operation for organized ventilation releases for the NSC installations, and considering possibilities of dismantling only after commissioning of new ventilation stack.

The accident event impacts at other ChNPP facilities (Liquid RAW Processing Plant, Industrial Complex for Solid Radwaste management, Spent Fuel Storage # 1, Spent Fuel Storage # 2) will not cause additional impact on the NSC.

2.3.3 INTERNAL INITIAL EVENTS

2.3.3.1 Internal Fire

The fire safety measures shall be based on the following:

- Fire safety regulations requirements;
- SIP ongoing and completed work;
- Fire safety measures that are being implemented as part of operation activities.

The risk of fire in the NSC CS-1, as an internal initial event, will be addressed both for its construction and commissioning stage and NSC CS-1 operation. During consideration, only one place of fire ignition shall be contemplated: either one of the Shelter areas, or one of the rooms of the NSC CS-1 process unit (Technological building).

The inflammation (fire) sources during NSC construction and operation include:

- Fire activities (welding, cutting, etc.);
- Short circuit in electrical wiring and equipment;
- Handling of fire hazardous materials (paint, etc.);
- Unauthorized actions (arson);
- Negligence in handling fire.

The total amount of combustible materials inside OS is estimated to be approximately 2.000t.

Spontaneous inflammation of these combustible materials inside the Shelter is unlikely due to the following reasons:

- The group of main rooms does not have any production activity with permanent use of open fire and there is round-the-clock monitoring of fire conditions
- Most cable tunnels do not have any energized cables or any other ignition sources. The Shelter Fire Mitigation Plan SIP-P-TM-16-235-TSN-017-01 envisions passportization of rooms with provision for specific information on the cable rooms;
- The uncontrolled heating of FCM could be considered a hypothetical source in the inoperative rooms. However, the heat power of such sources is low, and the average temperature in the areas with combustible materials cannot exceed the value of spontaneous inflammation temperature.

NOVARKA shall submit thermodynamic analysis of the maximum possible fire in NSC CS-1 based on the 3D facility model, taking into account the design solutions addressing the NSC CS-1 elements, including structural elements of crane tracks and main cranes, and also ensure stability of all the structures for the case of the most severe fire.

NOVARKA will calculate the dynamics of smoke generation and the associated radiological consequences inside the NSC CS-1 and propose the organizational measures and/or develop the design solutions to mitigate the radiological consequences and remove smoke.

The following characteristics of fire will be utilized in the Design [1.12.15]:

- The most severe potential fire may occur on the Turbine Hall roofing and on Deaerator Stack (DS) roof. It may have the following characteristics:
  - Fire load on the Turbine Hall roofing and DS roof consists of 4 layers of Class PM-350 coating material with thickness of 0.5mm with hot bitumastic of Class MBK-1-55 with total thickness of 15mm;
  - Fire load caused by fire on the Turbine Hall roofing and DS roof is 20.8 kg/m^2;
  - Warm from combustion is 29.485 MJ/kg;
  - Maximal speed off fire load burnout is 0.00258 kg/(m^2 •·s);
  - Maximal flame temperature is 1200 ^{0}C ;
  - Value of air needed for 1 kg combustion is 9.45 m^3/kg;
  - Temperature inside the NSC CS-1 space and structures till fire event is 30.0 ^{o}C ;
  - Temperature outside the NSC CS-1 is 20.0 ^{o}C;
  - Density of gas combustion products is 0.1 kg/m^3;
- Fire resistance to be taken into account for load bearing and fencing structures of NSC CS-1 case is 30 min;
- NSC CS-1 will be addressed as a facility with the combined coating containing the following indicators of fire resistance for structural elements:
  - For load – bearing components, i.e., arches, farm bars the resistance limit R is 30 minutes, maximal limit of fire spreading for them is M-0cm;
  - For fencing elements, i.e. flooring and purlins, minimal fire resistance limit is RE 30 minutes (E – is preservation of integrity), maximal limit of fire spreading through them is M – 0 cm.

NOVARKA shall develop and perform the fire resistance test program for the materials used for the internal ceiling and coating of the main structures.

2.3.3.2 Structural Collapse inside NSC

2.3.3.2.1 Introduction

We can differentiate between three different stages in the NSC operating life:

- Erection and Sliding
- Operation prior to OS early deconstruction works
- Operation during early deconstruction works (CS-2)

At every stage, safety of the NSC and its encompassed structures must be ensured.

2.3.3.2.2 Erection and Sliding

During erection and sliding, the stability of the NSC is dependent on the design solutions and the erection methodology. The Design will therefore provide the appropriate calculations and justifications for the NSC CS-1 stability or potential induced OS collapse.

2.3.3.2.3 NSC in final position, deconstruction not started

The OS structures have undergone a series of stabilization measures in the framework of SIP program in order to increase the reliability of the OS “localizing construction”. Notwithstanding this operation, the reached reliability level was not sufficient according to the norms regulating radiological safety. A qualitative analysis can however help in the assessment of the situation.

- **OS adjoining structures forming part of the NSC envelope**

  These structures have a special role as they form part of the NSC envelope. In this respect, they must have a design life compatible with that of the NSC. Therefore, their possible reinforcement is being evaluated by the Employer and if corrective actions are required, the Employer will authorize their implementation within the expected timeframe of the NSC project, with the same resistance as the NSC against normal operation, violation of normal operations, emergency situations and accidents.

- **South Wall of Turbine Hall**

  This area presents a serious risk of collapse. However, a geometric analysis of an extreme collapse scenario (where the turbine hall wall rotates in the direction of the NSC arch) shows that this collapse scenario would not impact the NSC load-bearing Arch structures. In depth analysis of collapse scenarios shall be included in the SAR based on Employer provided information

  In any case, the geometry of the arch, based on the height of the turbine hall south wall, allows for sufficient clear space so that a collapse of the turbine hall south wall will not hit the Arch, even if the entire wall falls over to the south.

- **North (Cascade) Wall**

  The wall is a solid, large mass of concrete that is very stable, and collapse during the NSC lifetime (100 years) is not credible.

- **OS other areas**

  All other sections of OS have been stabilized, and the stabilization measures have a specified design life during which the stabilized structures are supposed to be deconstructed.

  If required by the RA, the Employer will produce a Technical Decision on this topic.

- **Consequence on NSC design**

  From the above qualitative assessment, it can be seen that in an event of partial or total OS collapse, no section of the OS will physically impact the arch structure. In particular, no credible OS collapse event impacting the Arch southern structures is envisioned. Thus, stability of NSC amounts to its intrinsic stability that shall be demonstrated in the Design.

  Nevertheless SSC IS-1 shall be located inside NSC in such a way to exclude mechanical shocks as a result of SO structures collapse or achieve the safety criteria through adequate redundancy.

  If required by the RA, the Employer will produce a Technical Decision on this topic.

  The Design will consider risks related to the events of the SO structures collapse, from the standpoint of dust raise and spreading, personnel exposure inside the NSC, release from

the NSC and nuclear safety (see section 2.6.2). Measures on personnel and environmental protection during such event will be envisioned.

All consequences of such a collapse are treated in the same manner as described hereunder.

2.3.3.2.4 Operation during early deconstruction works (CS-2)

Collapse risks are likely to be predominant during deconstruction works.

Based on the existing studies, (NSC FS (CD)) and on the on-going definition of CS-2 scope, NOVARKA will review the risks induced by the envisioned deconstruction scenarios. After CS-2 DCR concurrence, NOVARKA will consider the requirements that it contains DCR upon notification by the Employer.

NOVARKA will guarantee the compliance with the safety criteria in two ways:

– Engineer specific design solutions;

– Clarify the framework for performance of deconstruction activities (usually by imposing restrictions in terms of loads or flying over SSC IS-1 equipment).

These will be defined as Design Criteria applicable to CS-2 activities.

A typical design criterion will be that deconstruction scenarios shall not jeopardize the integrity of the NSC structure unless their probability is compliant with the applicable sanitary legislation (NRBU-97/D-2000 – See also section 2.6.3 of the CDSD). .

On the basis of this review, it will be possible to determine the location where NSC systems and components should not be placed in order to minimize (exclude) the risk of their failure as the result of mechanical impact of the structures. Alternatively, redundant schemes shall be imple-mented.

Non-structural impacts likely to be generated during deconstruction activities (radioactive dust releases, fire events, gas releases, explosions…) will be handled through representative cases leading to specific design solutions. In the Framework of this analysis, NOVARKA will use the input data available in the Attachments to its scope of work, in particular the Deconstruction Scenario (A37) and its attached radiological safety assessment (A34). The definition of accident scenarios and associated probabilistic safety assessments is under the scope of CS-2 works which is beyond NOVARKA's duties (see section 1.5).

Specifically, NOVARKA will define the ventilation and filtration systems taking into account the maximum possible dust generation (OS total collapse) and considering the dynamics of dust suspension and dissemination in the NSC main volume. This determined, the radiological con-sequences will be calculated and assessed i.e. personnel exposure doses on work places (con-sidering the dose accumulation with time), the release to the environment (given the ventilation system operation modes) and the level of contamination of the structures, systems and compo-nents of the NSC CS-1.

In case additional criticality study or increase of neutron yield study over those contained in the Object Shelter Safety Status Report, the Employer will perform them with NOVARKA's support.

2.3.3.3 Load Drop

The maximum load drop in terms of weight and/or size during construction, commissioning and operation of NSC should be addressed as initial event.

The initial events should be addressed in the safety analysis. The required organizational and technical measures shall be identified resulting from the analysis.

The load drops should not result in damage to load bearing and walling structures, NSC life support systems or change to FCM parameters.

2.3.3.4 Flooding

Design will address the following potential sources of internal flooding:

- Water supply and sewage pipelines;
- Heating pipelines;
- Fire-fighting system;
- System elements with water use.

To mitigate the risk of flooding connected to the damage of equipment and pipelines the following will be provided for:

- Design solutions facilitating the water income cessation at pipeline breaking;
- Systems for collection of organized and unorganized leakages;
- Waterproof cladding of rooms with potential for leakage of water and/or radioactive medium, providing for sloping floors and collector pits;
- Use of foam or gas extinguinshing agent instead of firewater wherever achievable;
- Monitoring of authorized discharges.

Analysis of flooding impact on NSC safe operation shall be performed in the Design and if necessary the measures to exclude or mitigate these impacts shall be defined.

Moreover, during the Design effort, water leak-tightness will be required of the NSC in order to reduce flood hazards inside the OS rooms for the purpose of prevention of the expansion of the liquid radioactive media from OS to the other NSC areas.

2.3.3.5 Internal Explosion

Theoretically an explosion inside the NSC could be caused by the following explosion hazardous materials:

- Radiolytic hydrogen;
- Fine-dispersed dust in the air;
- Explosive hazardous substances (benzine, kerosene, carbide, etc.) used in technological operations and during work implementation.

The risk of internal explosion will be practically excluded, since the following measures shall be provided to eliminate the explosion initiators:

- Use explosion proof equipment where drastically required;
- Use explosion and fire resistant cables where drastically required;
- Use short circuit protection and cable overload protection;
- Limit the amount of explosion hazardous substances in a room. Here, maximal permissible norms for storage and application of these substances taking into account the needs for dismantling will be estimated;

- Develop and implement a set of organization measures eliminating unauthorized use of fire in rooms, and unauthorized access for the personnel.

As far as impacts related to SSCR are concerned, based on the recent and previous analyses including "Current OS Safety Analysis", the SSCR probability is estimated as very low. If SSCR occurs, there are no additional force impacts, which may prevent the NSC from performing its confining functions. SSCR event and potential exposure to workers are discussed in the Protection from Potential Exposure Report [1.10.4].

The Design shall confirm the above conclusions related to the NSC taking into account the Shelter condition after completion of the early deconstruction of the unstable structures.

If necessary, corresponding organizational and technical measures will be considered.

2.4 REQUIREMENTS AND CRITERIA FOR STRUCTURAL DESIGN

2.4.1 MAIN DESIGN REQUIREMENTS

This section contains design criteria and requirements to Detailed Design of the NSC CS-1.

NSC CS - 1 should comply with [1.2.17] per classification of buildings, facilities and structures by their responsibility for nuclear and radiation safety (NRS); comparison of this classification with NSC SSC classification of impact on NRS is provided in Section 2.6.3.

To ensure NRS for Class SSC IS-1 constructions, the following requirements should be executed determined in:

- ПиН АЭ-5.6 [1.2.17] for Category I Responsibility for NRS facilities;
- ПНАЭГ-5-006-87 [1.2.15] for Category I Seismic Resistance facilities;
- ДБН В.1.1-7-2002 [1.3.18] and ВБН В.1.1-034-03.307-2003 [1.3.25] for Grade 1 Fire Resistance facilities.

If this CDSD chapter establishes requirements differing from one stated in the above documents, it is necessary to use the requirement stated in this chapter (for example, concerning requirements for account of impacts from tornado, external explosion, aircraft fall).

Assurance of radiation safety at the level required by the effective Ukrainian legislation should be the main design requirement and priority criterion for selection of planning and engineering decisions for NSC. One should take into account that installation and operation of the NSC will require significant numbers of personnel who will work at high risk of long-lived radionuclide inhalation, which are characterized by high radiotoxicity.

In accordance with the requirements of the Minregionstroy of Ukraine, the NSC is considered a “unique” (experimental) facility that requires scientific and technical support during NSC Design development and operation.

The NSC CS-1 Design will ensure no or minimized loads from the east NSC CS-1 frame design on the existing structures of the Auxiliary Systems of Reactor Unit, central part of Unit “B” and the Deaerator Stack. If the loads are applied to the existing structures, NOVARKA shall perform the calculations of their strength and life. The results of these studies may require stabilization of the existing structures. NSC technical decisions shall not prevent the decommissioning process of Unit 3.

During activities on CD NSC (FS) according [1.7.3], the “Scientific and Technical Support Plan” [2.6.23] has been developed. It addresses in particular the finalization and experimentally simulated (mock-up, full scale model, test grounds) testing for the most important technical solutions and technological operations (e.g. structural foundation types and arch shapes, evaluation of aerodynamic coefficient in wind tunnel, unstable structural deconstruction sequence, local tightness and strength testing for welds and joints, etc.).

The Objective of [2.6.23] is to ensure NSC work performance quality control both at construction and operation stages.

During the Detailed Design and construction, [2.6.23] will be revised based on the data obtained during these stages, which should also reflect personal dosimetry monitoring and work site radiation factor assessment.

Development of construction technology, providing for maximum volume of construction and erection activities in the relatively clean area to minimize the collective dose of personnel during NSC CS-1 construction as well as the NSC CS-1 technical and technological solutions, should

be optimized to provide for minimization of personnel collective dose and impact on the environment during NSC CS-1 construction. This is one of the bases for the Design development.

In this section fire safety requirements are not mentioned. They are provided precisely in Sections 2.9.3 and 2.11.2.

2.4.2 LOADS AND IMPACTS

2.4.2.1 Loads and Impacts under Normal Operation Conditions

Values of loads under normal operation of the facility according to [1.7.7] will be confirmed and considered to satisfy main and special loading combinations:

1. Dead Load

Based on [1.7.7], dead structural and soil loads will be determined from the structural and soil design sizes and specific gravity of the materials:

Structural Overloading Factor:	1.1 (For metal structures where efforts of dead load exceed 50%, Table 5.1 [1.7.7]), 0.9 (During the process of verification of stability against tilting of structures and in other cases when the deterioration of structures and soil weight worsens the operating conditions, see Table 5.1 [1.7.7]).
Soil Overloading Factor:	1.15 (for backfilling see Table 5.1 [1.7.7]), 0.9 (During the process of verification of stability against tilting of structures and in other cases when the deterioration of structures and soil weight worsens the operating conditions, see Table 5.1 [1.7.7]).

2. **Roof Live Load**

The roof live loads will be considered on any circulation for arch inspection and/or preventive or curative maintenance.

Conservatively and to provide some flexibility in the design the following will be considered:

Characteristic uniform load:	0.5 (50) kPa (kg/m^2) (Table 6.2, Item 9C [1.7.7])
Overloading Factor Design Concentrated:	1.3 (Item 6.7, [1.7.7])
Quasi-Permanent Load:	0.15 (15) kPa (kg/m^2) – [Ref EN 1990- Annexe A1, see also section 4.2.5.1] – Table 6.2, Item 9C [1.7.7] does not sepcficy design value for quasi-permanent loads
Characteristic Point Vertical Load:	1.5 (150) kN (kgf) (Item 6.10(a), [1.7.7])
Overloading Factor for maximum Values:	1.2 (Item 6.11, [1.7.7]).

3. **Floor Live Load**

Design values of uniformly distributed live loads on floor slabs, stairs, and floors on grade will be accepted as specified in Table 6.2 of [1.7.7] (see below). Provision will be made in designing floors for the point live loads as described in Section 6.10 of [1.7.7].
* Item 2: service rooms for administrative, engineering and scientific personnel of organisations and establishments, utility rooms (gowning rooms, showers, wash and lavatory rooms): characteristic = 200Kgf/m², quasi permanent = 85Kgf/m²

* Item 3: Rooms for electronic computers: characteristic = 200Kgf/m², quasi permanent = 120Kgf/m²

* Item 4: Halls, for waiting: characteristic = 400Kgf/m², quasi permanent = 170Kgf/m²

* Item 9: roofs above areas: a) with possible accumulation of people (industrial premises, halls) characteristic = 400Kgf/m², quasi permanent = 170Kgf/m², b) used for the rest: characteristic = 150Kgf/m², quasi permanent = 60Kgf/m²

* Item 11: section for maintenance and repair of equipment in industrial premises: characteristic = 150Kgf/m²

* Item 12: staircases (with related passages) for rooms of items 2 and 3: characteristic = 300Kgf/m², quasi permanent = 100Kgf/m², for items 4 and 11: characteristic = 400Kgf/m², quasi permanent = 170Kgf/m²

Special consideration will be given for each slab or floor. This will include the characteristic value and quasi-permanent value assumed to be 30% of the characteristic value. – [Ref EN 1990- Annex A1 see also section 4.2.5.1], [1.7.7] does not specificy such a value..

4. **Crane Loads**

According to CD NSC (FS), to support the deconstruction of unstable structures and future FCM and RAW management activities, the NSC will be equipped with four suspended cranes (two cranes on the north and two cranes on the south side) that may move in the West-East direction and cover the Shelter area from the north buttress wall to the Octopus beam inclusively.

Design system of main cranes will be based on the following requirements [2.6.9]:

- Minimal lifting of the main cranes hooks is 77m related to the late site level 0 (114m);
- Distance of hoisting will satisfy the unloading at final floor level of internal NSC composition;
- Area of crane grabs is between axes 40-62 and lines T-Б (except maintenance garages and span of the telescopic mast);
- Capacity of two cranes with standard mobile platforms is to be sufficient for dismantling of beams Б1, Б2, as well as “Mammoth” beam after division of “Mammoth” beam into two parts. Simultaneous utilization of three platforms at one crane way is not required.

Horizontal movement of mobile platform might be permitted only in its fully retracted position. Mobile platform will be considered as tool of the main cranes system.

The following characteristics developed at CD NSC (FS) will be provided as initial data for detailed design:

- Each crane consists of the 42m length platform fixed to 2 or 3 girders-roads on ends and in middle of bay, and the carriage of three kinds:
- Standard lifting carriage of capacity 50 ton-force;

- Special carriage for transportation of the personnel in protective box (Capacity of 50 ton-force);
- Carriage with telescopic mast equipped with vacuum cleaner and hydraulic drive for concrete drill, jaws or mechanical shears.

NOVARKA will provide list of feasible tools to be used on the mobile platform on the sole basis of the NSC FS (CD) dismantling scenario. These tools will be commercially available on sale.

NOVARKA will develop and submit to the Employer the Technical Specifications on connection of the tools and equipment to the system of main cranes. Technical Specifications should include descriptions of the limiting conditions of system of main cranes.

The NSC CS-1 structures addressed in the Design will be designed for crane load combinations applied to any intermediate beams that may occur under possible unfavourable locations of cranes and carriages in garages taking into the presence of one loaded carriage or the simultaneous presence of two unloaded carriages on one quadrilateral.

Based on [1.7.7], for operation mode group 4K to 6K crane (average crane usage), the following overloading and dynamic factors will be considered:

Overloading Factor	1.1 (item 7.14, [1.7.7]);
Factor of Dynamic	1.1 (item 7.15, [1.7.7]).

Longitudinal and transversal horizontal loads induced by crane movement, carriage breaking and impacts on the end-stop bumpers will be considered in accordance with Section 7 [1.7.7].

Calculations of the seismic load will be realized, taking into account the weight of the bridge-cranes and of their trolleys in combination with the vertical seismic loads. When defining calculated vertical seismic load, the weight of the bridge crane, weight of trolley as well as weight of load equal the crane carrying capacity multiplied by factor 0.3 will be taken into account (see Section 2.1.2 [1.7.5]). The design horizontal seismic load from weight of crane bridge will be considered in direction perpendicular to axes of crane beams. The lowering of crane loads foreseen by [1.7.7] will be not taken into account by this.

5. **Erection Loads**

In Ukrainian norms the climatic actions taken into account in the erection phase load combinations are independent from the duration of the erection phase considered. Since the NSC construction has erection phases of different durations, it is recommended to use the return periods for climatic actions depending on the duration of the erection phase (criteria extracted from European norms). The use of these specific design criteria will be justified during the design.

Erection loads are tentatively addressed in the CD NSC (FS) and will be finalized in the Design Phase based on [1.7.7], since they are mostly to be driven by NOVARKA’s equipment characteristics and erection procedure.

Any loads occurring in the course of erection will be considered in the design as short-term loads [1.7.7].

Specific Design Criteria for the erection phase will be developed during the Detail Design considering the facility to be constructed.

According to EN 1991-1-6, it is possible to take into account the duration of each execution phase to determine the characteristic values of climatic actions. It has to be noted that [1.7.7] does not specify such detailed durations.

The recommended return periods are given in the Table 3.1 of the EN 1993-1-6 (here below).

DURATION	RETURN PERIOD (YEARS)
≤ 3 days	2[a]
≤ 3 months but > 3 days	5[b]
≤ 1 year but > 3 months	10
> 1 year	50

[a] A nominal duration of three days, to be chosen for short execution phases, corresponds to the extent in time of the reliable meteorological predictions for the location of the site. This choice may be kept for a slightly longer execution phase if appropriate predictions for the location of the site. This choice may be kept for a slightly longer execution phase if appropriate organisational measures are taken. The concept of mean return period is generally not appropriate for short term duration.

[b] For a nominal duration of up to three months, actions may be determined taking into account appropriate seasonal and shorter term meteorological climatic variations. For example, the flood magnitude of a river depends on the period of the year under consideration.

As per Item 4.20 of DBN B.1.2-2:2006 “In specifying design load combinations for structures and foundations over the period of buildings and facilities erection, snow, wind, ice loadings, as well as temperature and climatic effects, included in design combinations, should be reduced by 20%”. In NSC design the above requirement of DBN B.1.2-2:2006 shall be followed.

6. **Transport Arch Sections – Assembly Areas to Design Location**

Loads on the arch base sections, frictional resistance of arch base sections, induced horizontal or vertical displacement, and any other load caused by the movement of the NSC arch structure from its assembly location to the design position over the OS will be engineered in the Design.

During transport phase of arch, it will be considered a wind action of 10m/s at 10m height.

Any loads occurring in the course of production, storage and transport of any structures will be considered in the design as short-term loads.

During Arch transfer, specific loads will be considered. These will be developed depending on the specific transfer methodology, considering the complexity of the facility to be ocnstructed.

7. **Differential Settlement Loads**

Effects of differential settlements will be calculated in the Design.

The effect of differential settlements will be accounted for in calculating base deformation (category 2 of limit states).

8. **Earth Pressure and Lateral Pressure**

Effects of earth pressure and lateral pressure will be included into the Dead Loads section.

Vertical earth pressure and static lateral earth pressure will be calculated using the soil characteristics (density, angle of internal friction and cohesion) obtained in the results of field and laboratory soil tests.

9. **Utilized Material Stability**

Design will utilize the material for the load bearing and fencing structures whose properties (considering maintenance and repairs, based on the maintenance minimization principle) and structural support loads will not be changed with time. These materials will meet the facility life requirements (at least 100 years).

2.4.2.2 Extreme Loads (Special)

Values of specific (extreme) loads are presented in Section 2.3.1 of the this Chapter. Given loads will be considered in compliance with requirements established in this Chapter in particular Sections 2.3.1 and 2.4.1.

2.4.2.3 Load Combinations

2.4.2.3.1 NSC Loading Combinations

The load combinations will meet the requirements of [1.7.7] and [1.7.5], as well as [1.2.17] and [1.2.15].

Tables 2.4.1 – 2.4.3 provide load combinations, design loads and dynamic coefficients.

2.4.2.3.2 NSC Foundation Loading Combinations

The NSC bases and foundations reliability will be justified by calculationsn of two groups of extreme conditions: first – load bearing capacity, second – deformations. In designing bases and foundations, advanced methods and models that take into account interaction of the upper structure, foundations and bases will be utilized.

The design of bases under deformation and load bearing capacity will meet [1.2.16] and [1.7.16].

Table 2.4-1. Structural and Foundation Load Combinations

Load Combination		**Combi-nation#**	**Permanent loads**	**Temporary Loads**								Note
				Long term loads	**Short term loads**	**Emergency**						
						Extreme snow	**Extreme wind**	Extreme temperature	Tornado	**Seismic**	**Blast**	
Main		1	+	1 long term	-	-	-	-	-	-	-	
		2	+	-	1 short term	-	-	-	-	-	-	See item 1
		3	+	0.95(∑long term)	0.9(∑short term)	-	-	-	-	-	-	See item 3
Emergency	Seismic	1	0.9 perm.	0.8 ∑ long term (except snow)	0.5(snow+erection)	-	-	-	-	+	-	See items 4, 2
	Extreme snow	1	+	0.95(∑ technol.)	-	+	-	-	-	-	-	
		2	+	-	0.8 ∑ short term (except snow)	+	-	-	-	-	-	
		3	+	0.95(∑ technol.)	0.8 ∑ short term (except snow)	+	-	-	-	-	-	
	Extreme temperature	1	+	0.95(∑ long term)	-	-	-	+	-	-	-	
		2	+		0.8 ∑ short term	-	-	+	-	-	-	See item1
		3	+	0.95(∑long term)	0.8∑ short term	-	-	+	-	-	-	
	Extreme wind	1	+	0.95(∑long term)	-	-	+	-	-	-	-	
		2	+	-	0.8 ∑ short term (except wind)	-	+	-	-	-	-	See item 1
		3	+	0.95(∑long term)	0.8 ∑ short term (except wind)	-	+	-	-	-	-	
	Tornado	1	0.9 perm	-	-	-	-	-	+	-	-	See item 5
		2	0.9 perm	0.95(∑long term)	-	-	-	-	+	-	-	
		3	0.9 perm	-	0.8 ∑ short term (except wind & snow)	-	-	-	+	-	-	
	Blast	1	+	0.95(∑long term)	-	-	-	-	-	-	+	See item 1
		2	+	-	0.8 ∑ short term	-	-	-	-	-	+	
		3	+	0.95(∑long term)	0.8 ∑ short term	-	-	-	-	-	+	

Note:

1. Snow load should be considered with K=0.3 in addressing long term load or K=1.0 for short term load. Factors of load combination have been accepted according to Item 4.18 [1.7.7];
2. In calculating special load combination with seismic impact, the snow load is determined per [1.7.5];
3. During the design, the most unfavourable physically possible of all cranes and carriages, considering carriages in parking garages;
4. Seismic loads are considered for Design Basis Earthquake (DBE) and Maximum Design Earthquake (MDE). The overload coefficient value should be taken in accordance with [1.7.5]. In combinations of loads for DBE except for the specified loads of normal operation it is necessary according to [1.2.15] to take into account loads of design accidents;
5. Tornado design load is class 1.5. Tornado class 3.0 loads will be analysed as beyond design basis event – see section 2.3.1.4.

Table 2.4-2. Main Load Combinations

Load Classification	Design value kPa (kg/m^2)/ºC	Combination Factor ψ_1, ψ_2	Dynamic Factor	Chapters in ДБН В.1.2-2:2006
Permanent loads				
Dead load	-	1,00	-	4, 5
Earth and lateral earth pressure	-		-	4, 5
Live Loads				
Long term loads				
Roof live load	see Note (6)	0,95 see Note (3)	-	4, 6
Floor live load	see Note (5)		-	4, 6
Crane load	see Note (1)		1,1	4, 7, Attachment Г
Snow load	see Note (2)		-	4, 8, Attachment Е, Ж
Temperature load	see Note (7)		-	4, 11
Short term loads (9)				
Snow load	1,813 (181,3)	0,90 / 1,00; 0,80; 0,60 see Note (4)	-	4, 8, Attachment Е, Ж
Wind load	0,513 (51,3)		-	4, 9, Attachment Е,, I
Crane load	see Note (8)		1,1	4, 7, Attachment Г
Temperature load	-22 / +29		-	4, 11

Notes:
(1) Vertical load of one crane is calculated in accordance with items 4.12 and 7.2 [1.7.7];
(2) It is calculated according to items 4.12к and 8.2 [1.7.7];
(3) It is defined according to item 4.18 [1.7.7]).
(4) For combination of permanent and at least two live loads factor 0.9 is applied for short-term ones; for consideration of three and more short-term loads combination factor of 1.0 is taken for the first of impact, 0.8 – for the second of impact and 0.6 – for others;
(5) For information regarding technological loads on floors see item 2.4.2.1 (3) of the present document;
(6) For information regarding technological loads on roof see item 2.4.2.1(2) of the present document;
(7) It is calculated according to items 4.12л and 11.3 [1.7.7];
(8) It is calculated according to items 4.13г and 7.2 [1.7.7].
(9) For Roof & Floor, specific moving equipment loads will be taken into account as short term loads.

Table 2.4-3. Extreme Loading Combinations

Load Designation	Design value kPa (kg/m^2)/ºC	Combination Factor ψ_1, ψ_2	Dynamic Factor	Chapters in ДБН В.1.2-2:2006
Permanent loads				
Dead load	-	1,00	-	4, 5
Earth and lateral earth pressure	-		-	4, 5
Live loads				
Long term load				
Roof live load	see Note (5)	0,95	-	4
Floor live load	see Note (4)		-	4
Crane load	see Note (1)		1,1	4, 7, Attachment Г
Snow load	see Note (2)		-	4, 8, Attachment Е, Ж
Temperature difference	see Note (6)		-	4, 11
Short term loads				
Snow load	1,813 (181,3)	0,80	-	4, 8, Attachment Е, Ж
Wind loads	0,540 (54,0)		-	4, 9 Attachment Е, І
Crane loads	see Note (7)		1,1	4, 7, Attachment Г
Temperature difference	-22 / +29		-	4, 11
Special loads				
Earthquake	see Note (3)	1,00	-	
Tornado	see Note (3)		-	
Wind (extreme wind)	0.864 (86,4) see Note (8)		-	
Snow (extreme snow)	2.1(210) see Note (8)		-	
Temperature difference	-43 / +45		-	

Notes:

(1) Crane loads with tornado (class 1.5) and earthquakes (DBE and MDE) take into account the text according to items, 2.3.1.4, 2.4.1 and 2.4.;

(2) It is calculated according to items 4.12к and 8.2 [1.7.7];

(3) Tornado extreme load is class 1.5. Tornado class 3.0 loads will be analysed as a beyond design basis event – see section 2.3.1.4.. Maximum basis earthquake is used for extreme seismic loads;

(4) By technological loads on floors see item 2.4.2.1 (3) of the present document;

(5) By technological loads on roof see item 2.4.2.1 (2) of the present document;

(6) It is calculated according to items 4.12л and 11.3 [1.7.7];

(7) It is calculated according to items 4.13г and 7.2 [1.7.7]; (8) Maximum values are taken for specific loads.

2.4.3 REQUIREMENTS FOR STRENGTH AND STABILITY ASSURANCE

The NSC CS-1 structural strength and stability will be provided for the whole period of NSC CS-1 operation with the observance of requirements to loads and impacts set forth in Section 2.4.2. Data on ground characteristics and hydrogeology of the construction site are set forth in section 3.1 of this CDSD.

2.4.3.1 Stability Requirements

For special load combinations, adequate overloading factors against sliding and overturning will be assured. The Detailed Design shall include the required data based on the technological solutions for pre-assembly, sliding, and erection in the design location.

Due consideration is to be given in selecting the arch configuration and in adopting arch span, height and stiffness that tend to minimize the horizontal reactions at the base under normal loading combinations.

2.4.3.2 Work Performance Conditions

Calculations of welded assembly joints performed in high radiation fields shall provide for another safety coefficient K_{dop} = 0 .7, compensating for the probable decrease in quality of work performed in these areas. The value of this coefficient shall be justified in the Detail Design.

2.4.3.3 Allowable Deflections and Drift

Deflections of the structural elements of the NSC shall be limited according to [1.7.26].

The vertical structural deflections of the NSC during erection shall be limited according to [1.7.15].

The acceptable deflection shall be revised during the Design based on the selected crane equipment requirements.

2.4.4 REQUIREMENTS FOR BASES AND FOUNDATIONS

2.4.4.1 Input data for design criteria and requirements

2.4.4.1.1 Lithologic morphology

Geomorphologically the Shelter industrial site is located within the limits of the right bank above floodplain terraces of the Pripyat River.

The absolute ground surface elevations of the Shelter industrial site prior to the construction of Unit 4 ranged from +114.00m to +116.00m BAS.

The man-made layer laid in the post-accident period is of very heterogeneous composition. It consists of crushed stone with sand and land waste, construction waste, concrete and reinforced concrete.

The thickness of the man-made layer evaluated from the ground surface before the accident varies in broad limits:

- From 8.0 to 10.0m near the southern wall of the Turbine hall from axes 35 to 60 and in the northern area of the cascade wall;

- From 3.0 to 8.0m near the southern wall of the Turbine hall from axes 60 to 68, along the western wall on axis 68 and the western area of the buttress wall;
- From 0.5 to 3.0m on the surrounding fenced part of the Shelter industrial site.

Under the man-made layer, there are quaternary alluvial deposits interlayers followed by marl deposits of the Paleocene Kiev suite. Under that layer, there are sands of the Paleocene Buchak-Kanev suite followed by the chalky marl deposits of the Santonian-Turonian period of the upper Cretaceous period.

2.4.4.1.2 Lithologic composition

The lithologic composition includes the following Engineering and Geological Elements - EGE - from top to bottom:

EGE	Description
1	Man-made layer, laid as post-accident compensating measure of high heterogeneity including layers of various soils (crushed stones, sands, loamy sands and clays), concrete, reinforced concrete, land waste and construction debris.
1A	Man-made backfill consisting of silty sands with loamy sand interlayers, gruss and crushed stones.
9	Alluvial soil of old riverbed facies (a_3^2st) made of unstable loamy sand.
10	Alluvial soil of old riverbed facies (a_3^2st) made of uniform water-saturated medium density silica sand.
14	Alluvial deposits of old riverbed facies (a_3^2pl) made of compact silty sand interlaid with non-uniform water-saturated medium density silica sands.
15	Alluvial deposits of beach facies (a_3^2pl) consisting of uniform water-saturated compact fine sand.
18	Alluvial deposits of riverbed facies (a_3^2pt) consisting of water-saturated fine compact sand interlaid with density silica sand.
19	Alluvial deposits of riverbed facies (a_3^2pt) consisting of uniform water-saturated medium density silica sand interlaid with compact sand.
20	Alluvial deposits of wash-off facies (a_3^2rf) consisting of uniform water-saturated sand of medium density silica sands interlaid with compact sand.
23	Middle quaternary alluvial deposits (a_2) consisting of water-saturated compact sand interlaid with medium density sand.
24	Middle Paleocene Kiev suite deposits (p_2kv) consisting of semisolid hard plastic loamy soil.

Below the middle Paleocene Kiev suite deposits (p_2kv), are successively encountered Buchak sand ($p_2b\check{c}$), Kanev sand and chalky-marl deposits of the Cretaceous period.

2.4.4.1.3 Geotechnical parameters

The geotechnical parameters recommended for the conceptual design of the foundations are:

EGE	Bulk density ρ (t/m³)	Effective strength parameters C (kPa) / φ (°)					Deformation modulus E (MPa)				
		Uniaxial shear tests	Triaxial tests	SPT	CPT	Design values	Uniaxial shear tests	Triaxial tests	SPT	CPT	Design values
1	2.00	0/29	5/36	-	0/39	5/32	18	30	-	39/21	25
1A	2.00	15/18	-	0/33	0/37	10/20	6.5	-	5/6.5	32/19	6.5
9	1.95	15/24	-	-	0/39	5/25	18	-	-	38/23	20
10	2.04	0/34	0/34	0/38	0/40	0/36	27.5	25	20/25	47/29	25
14	2.04	0/36	0/36	0/39	0/39	0/37	35.5	35	22/26	45/28	35
15	2.04	0/34	0/36	0/40	0/39	0/37	55	35	26/30	49/30	40
18	2.04	0/34	0/40	0/40	0/39	0/38	51.5	30	26/30	52/30	40
19	2.04	0/34	0/39	0/38	0/39	0/38	56.5	30	23/27	51/30	40
20	2.04	0/32	0/40	0/36	0/38	0/37	63	30	16/22	51/30	40
23	2.05	25/24	35/24	-	-	20/24	14	10	20/26	-	12

The recommended mentioned geotechnical parameters for the foundation design are preliminary. NOVARKA shall perform the additional geotechnical research and submit the report with the results of the research and document with the specified criteria related to geotechnical parameters to the Employer. The specified criteria related to the geotechnical parameters shall be approved by the Employer and concurred by RA. The scope of geotechnical research is described in Section 3.9. During the NSC CS-1 Design, conservative values of geotechnical parameters will be used for the foundations in the SO Local zone. These values will be confirmed at the stage of Working Documentation after carrying out investigation in this area.

2.4.4.1.4 Hydro-geological morphology

The area of industrial site close to "Shelter" object is a part of geomorphological central flood plain area of the first over-flood land terrace of the Pripyat river right bank. This area of the first over flood plain terrace is a flat drainage plain with a slight incline towards the Pripyat river and absolute surface elevations from 112 m up to 115 m according to BAS. Two parts are identified in this area: lower central part and slightly raised flood plain.

Water containing rocks belong to Eocene Bucha and Kanev suite depositions and are composed of sands interbedded with sandstone, aleurolite and clays. Total thickness of water containing rocks is on average about 40 m.

There are two aquifers: unconfined aquifer (0,5 to 35…40 m deep) into Pliocenequaternary depositions and confined aquifer (over 35…40 m deep) in the Eocene depositions (See the Shelter Safety Status Report and the Report on Research Radiohydrogeological monitoring in the area of Object Shelter” from the National Academy of Sciences of Ukraine, Scientific-Engineering Centre of Radiohydrogeoecological ground investigations).

Main area of confined aquifer discharge is in the valley of the river Pripyat.

Groundwater surface incline is about 0,001. In general, the ground waters move from the south to the north.

Mean elevation of the subsurface of unconfined aquifer in the Local zone and in SO Western zone was correspondingly, 110.06 m and 110.64 m [3.27].

2.4.4.1.5 Hydro-geological investigation results

Chemical laboratory analyses

Ground-water chemical analysis results are provided in Section 3.1.1.3 of this Document and in [3.27] (Sections 3.3.4 to 3.3.6).

Assessment of ground-water aggressiveness

The assessment of the ground-water aggressiveness is conducted for the upper aquifer in Pliocene quaternary alluvial deposits.

The ground-water aggressiveness is evaluated according to its aggressive impact on concrete and reinforced concrete structures.

This assessment is conducted according to SNiP 2.03.11-85 [1.7.10].

Per SO Safety State Report, the ground-water aggressiveness on concrete can be rated as non-aggressive for the permanently immersed elements and weakly aggressive for the periodically immersed elements.

Water-table level change

Based on the available data, the hydro-geological conditions in the area of the Shelter object may be described by two-layer scheme consisting of two aquifers with dividing intermediate layer, i.e., the first aquifer in Neogene quaternary alluvial deposits, the second aquifer in Bucha sand respectively above and under the five meter thick impervious mid-palaeogene Kiev suite.

Due to the site drainage outage and vertical drainage wells sealed in 1994, the general tendency of water-table level rise is observed.

Based on the linear regression curve drawn from observational data on monitored wells from the research from Feb 1996 thru Feb 2002, the water-table level rise can be estimated to 0.08m/year.

2.4.4.2 Geotechnical considerations to select foundation solutions

2.4.4.2.1 Basis for selection of foundation type

The recommendations provided in this section for selection of the proper type of foundation are based upon the analysis of engineering-geological site conditions (Refer to Section 2.4.4.1 and to Chapter 3 "Hydrogeological morphology and chemical data") and the engineering solutions derived during the Conceptual Design phase.

The technogenic layer reaches average depth of 6.0m to 6.7m from the ground surface.

The technogenic layer contains fragments of structural elements, steel and layers of concrete of various thickness and dimensions.

Since the technogenic layer is highly heterogeneous, since the derivation of geotechnical parameters for engineered-based design of the foundation is nearly impossible, the technologic layer shall not be considered as a possible supporting layer.

The technogenic layer is underlaid by engineered-backfill of 4.8m to 5.8 m thick laid after Unit 4 foundation was built.

Under the man-made fill, there are quaternary alluvial sandy argillaceous deposits on top of clay and sand layers of the mid-Paleocene period of 25.0…26.0 m thick followed by chalky marl deposits of the Cretaceous period of approximately 20.0 m thick.

The thickness of the chalky marl layer was derived from archive data and not from the geotechnical investigations.

2.4.4.2.2 Recommended foundation type

Based on the above assessment, it is recommended that continuous pile cap resting on the deep piles be constructed to support the arched structure. However this was reviewed during the conceptual design in order to achieve optimized superstructure and foundation design.

The recommendation is supplemented by the following geotechnical and structural engineering considerations.

1. Geotechnical considerations
    - Heterogeneity of the technogenic layer;
    - High degree of uncertainty or impossibility to determine geotechnical characteristics for the technogenic layer;
    - Impossibility to prognose the long-term filtration consolidation oc man-made layer.

2. Structural consideration
    - Arch structure vertical and horizontal reactions shall be taken by deep piles;
    - Pile cap is used as support structure to bear and distribute NSC loads, their transfer on piles, and guiding way for arch structure sliding;
    - During sliding the loads from friction shall betaken by the pile cap;
    - Steel tubing or other technologies shall be foreseen to provide protection against possible radioactive element ingress from radioactive contaminated soil layers into unspoiled layers during pile boring;

- Steel tubing or other technologies shall be foreseen to provide protection against possible radioactive element ingress from active soil layers into lower aquifers;
- Volume of radioactive waste management for the excavated soil from pile boring shall be limited;
- Classical method for deep foundation construction shall be used.

2.4.5 MAIN CRITERIA AND REQUIREMENTS FOR STRUCTURAL ARRANGEMENT SOLUTIONS

Requirements for volumetric-planning solutions to be utilized during designing of NSC main facility and auxiliary facilities, defined in NSC DCR and Document “Clarification on NSC Systems” are given below.

The requrements set forth for the solutions on structural arrangement shall be formulated on the assumption of facilities and systems located inside NSC. NSC CS-1 will include the buildings, facilities, structures, systems, areas, equipment, etc. the description of which is presented in Section 1.4.1 of Chapter 1.

Free access to the equipment, possibility for its free dismantling and transportation, as well as rooms-cabins for operators, operating the elements of technological process, will be foreseen at the process sites. Since main technological rooms refer to the Restricted Zone, they will be manufactured taking into account required radiation protection for the personnel.

Architectural and engineering solutions, in particular, layout of the NSC rooms, will be optimized aiming the following:

- Minimization of dose loads for personnel involved in construction and installation works of NSC.
- Minimization of dose loads for NSC operating personnel;
- Optimal zoning of NSC rooms in accordance with the OSPU requirements;
- Arrangement of optimal routes for the personnel movements between the NSC zones;
- Minimization of distribution of gas-aerosol contamination of OS existing air medium into main space and NSC rooms under normal operation conditions;
- Maximize containment of airborne contamination in case of emergency;
- Simplification of decontamination of the NSC rooms, equipment and structures;
- Prevention of non-controlled discharge of radioactive substances from the NSC volume.

Above mentioned issues will be detailed at the NSC CS-1 Design stage.

Zoning of the industrial Site, its facilities and rooms in accordance with the requirements of [1.2.3, 2.1.1] set forth in Attachment A.2.3 to this chapter will be fundamental point during resolution of volumetric-planning task of complex.

As far as possible, crossing of the personnel and vehicle flows from zone to zone during movement throughout the site and inside the rooms will be excluded in order to minimize the possibility for radioactive contamination.

Sanitary locks for additional service of personnel will be established in NSC due to high risk of contamination for the attendant personnel of NSC. These will include in particular rooms for changes and storage of the additional PPE, set of rooms for utilization of pneumatic suits, radiation monitoring rooms, ventilation centres, selected places for installations of restricting barriers, etc. Equipment and devices for additional PPE washing and decontamination will be

installed. At entrance to NSC, arrangement of sanitary locks for vehicles will be required. Requirements related to equipment of sanitary locks are given in Appendix 2.4.

To ensure safety for works performance and maintenance of own systems, the access ways, meeting the main safety requirements and, first of all, radiation safety requirements, will be developed and designed in NSC.

Upon their functional purpose, the access ways inside NSC will be divided into:

- Routes for the personnel;
- Evacuation routes for the personnel in case of emergency
- Routes for transportation of equipment and the materials
- Routes for RAW transportation.

During design of routes for the access ways, one will take into account that routes for RAW transportation shall not coincide with the routes for the personnel as well as with routes of the equipment and materials movement too.

Dose reduction along the access ways will be obtained by the following manner:

- Selection of the access way within the territory with more favourable radiation conditions;
- Utilization of transport means;
- Improvement of radiation conditions on the access ways or at their sections by:
    - Shielding of local ionizing sources;
    - Shielding of the access ways (or their sections);
    - Decontamination;
    - Dust suppression.

To access the work implementation areas, availability of at least one reserve route for the personnel evacuation will be foreseen besides the main routes.

When selecting the emergency routes, one is to take into account, that intensity of their utilization will be mostly less than intensity of utilization of the main routes.

Equipment of the access ways with the sanitary locks will be necessary for prevention of radioactive substances releases from the working areas.

For the purposes of repair or removal from the working area the contaminated equipment will be transported by the RAW routes.

To move the freights and personnel within NSC, the horizontal and vertical transportation schemes will be designed. Movement of radioactively contaminated equipment will be performed along the shortest possible way.

Composition of vertical transport schemes will include staircase-lift blocks, maintaining various access zones (through “hot” or “cold” sanitary lock). Evacuation routes will provide for safe evacuation of the maintaining personnel. Staircase blocks will be included in general scheme of evacuation for the personnel in case of emergency.

Access routes will be optimized taking into account fire safety related issues, in particular, of effective fire extinguishing, and the personnel evacuation in case of a fire. Requirements to fire protection system are stated in Section 2.11.

Medical care of the personnel, layout of catering points and issues related to special clothes processing after Change Facilities will be resolved within ChNPP infrastructure. During Design

effort the necessary design decisions will be developed as functions and requirements for different facilities and systems will be specified.

Corresponding criteria will be developed to consider all current architectural issues, including, but not limiting to the following:

- Routes of evacuation, movement and access for the personnel;
- Solutions related to the layout schemes, minimizing the exposure of personnel during construction and operation;
- Emergency exits in case of fire and other emergencies;
- Tightness of wall fencing of pile caps, roof, temperature joints and closing systems of the existing structures and interface with NSC foundation;
- Requirements for insulation and finishing of rooms of control panels, offices, and checkrooms;
- Requirements for materials of NSC roof and walls of framework.

2.4.6 REQUIREMENTS FOR DURABILITY OF STRUCTURES

The requirements for NSC durability will be defined by functional requirements for NSC operation. The total lifetime of NSC taking into account FCM and RAW removal is at least 100 years. The design solutions, including selections of materials will provide for indicated durability with minimum maintenance and repair of structures and their elements. To assess material durability the effect of exposure to radiation will be taken into consideration based on maximum average value of <0.1Gray/hr except elements of the main cranes system which might be located in more intense dose fields. For them, maximum dose rate values will be used. These values will be confirmed by site measurement or radiological calculation.

Simultaneously, possibility for extension of durability by means of individual elements reinforcement or replacement and other measures will be envisaged. The Design will also develop technical proposals for potential extension of NSC operational lifetime.

The Detail Design shall provide the specific measures facilitating ht NSC durability for 100 years, and specified proposals related to the potential extension of the operation period. Lifetime extension past 100 years will consider radiation dose reduction by the half-lives of the major radionuclides of caesium and strontium.

2.4.7 REQUIREMENTS FOR STRUCTURES ADJOINING AND INTERFERING WITH NSC STRUCTURES

These structures are:

- Block “B”;
- NIAS;
- Ventilation stack;
- Turbine hall and Deaerator stack structures;
- Separating walls;
- “Pioneer”, “Buttress” and “Cascade” walls.

The Accelerograms of response spectra to be taken into account are the followings:

3 three-component dynamic characteristics have to be used for the ChNPP site as MDE.

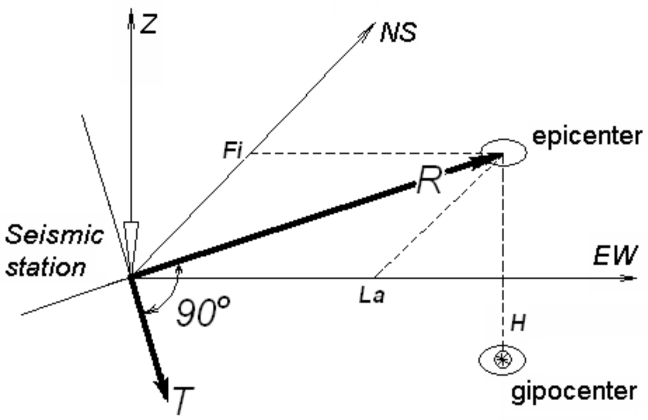


Figure 2.4-1. Directions of vibration components

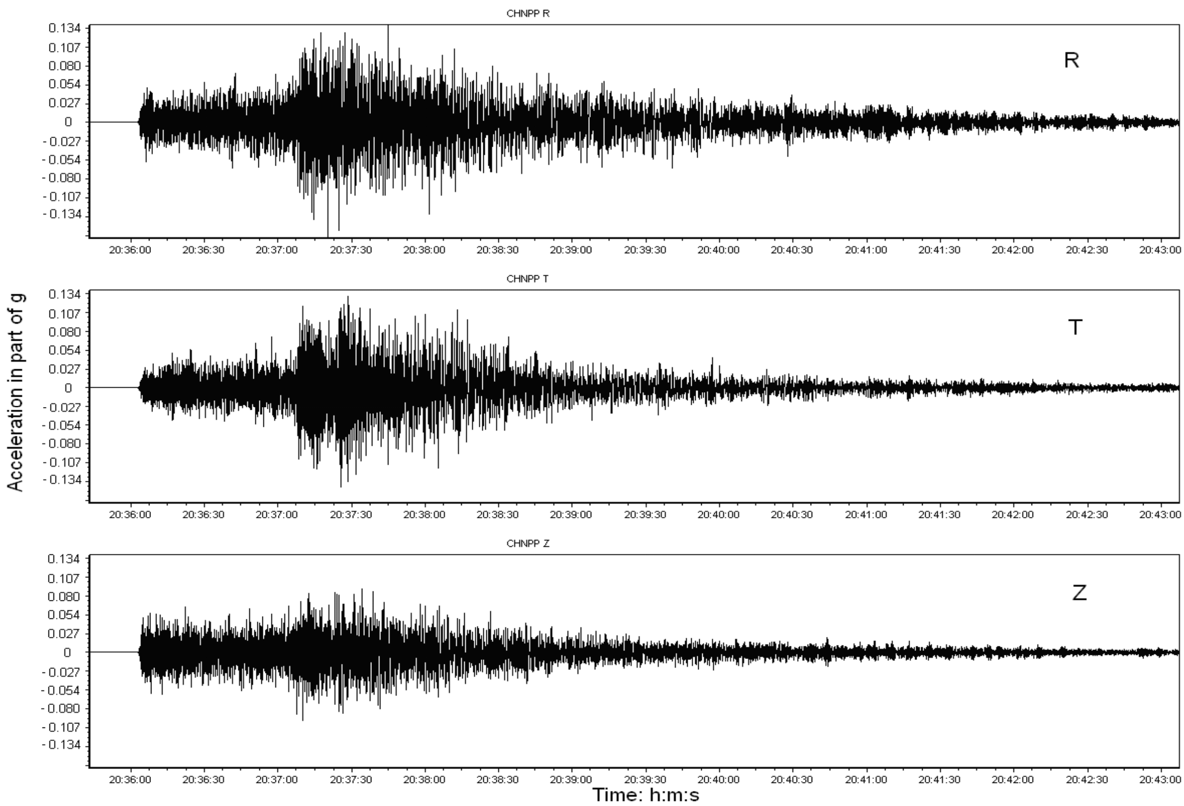


Figure 2.4-2. Three-component dynamic characteristics for earthquake “general”

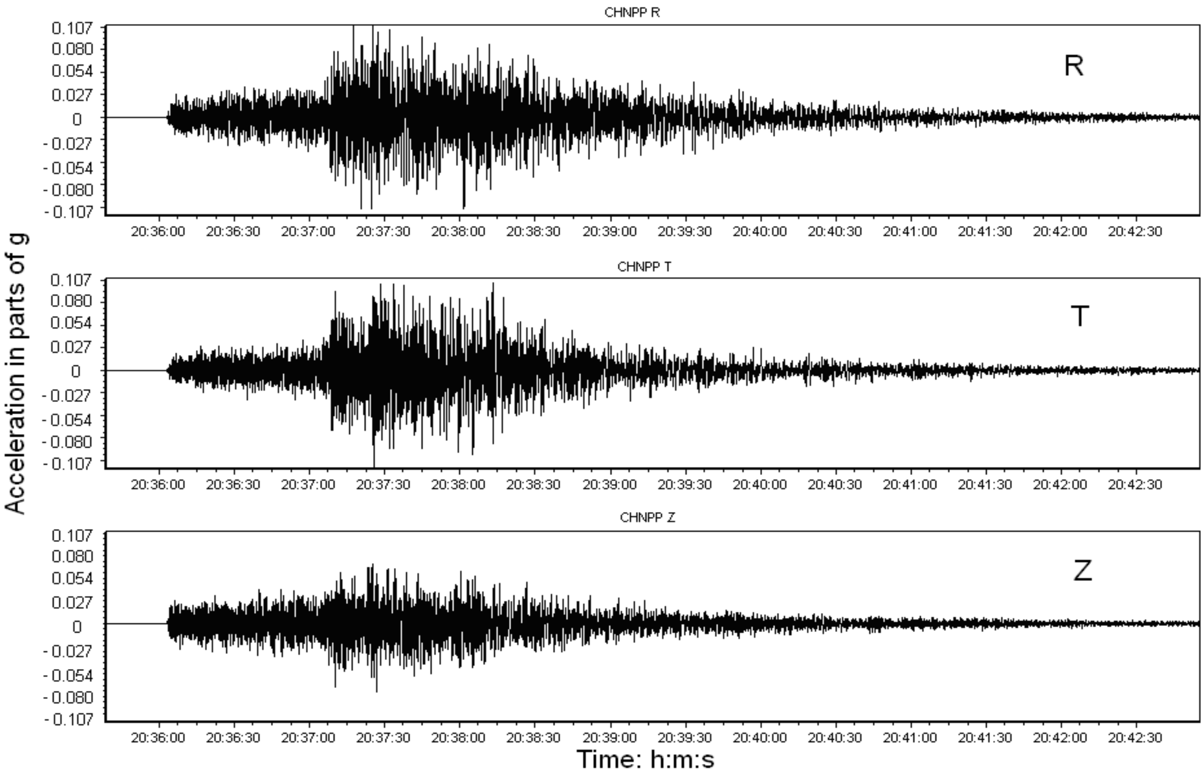


Figure 2.4-3 Three-component dynamic characteristics for earthquake "VC" (Vancrea zone)

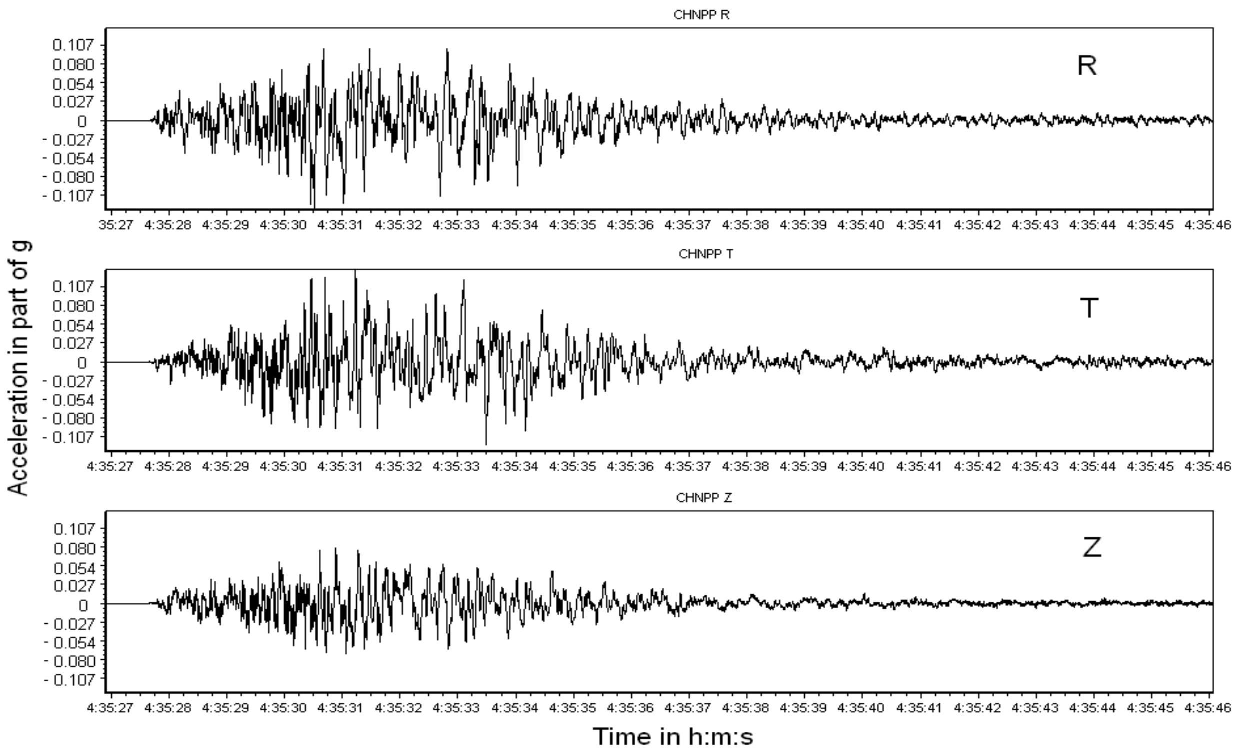


Figure 2.4-4. . Three-component dynamic characteristics for earthquake "LC" (Local)

At the Design stage, the Employer will provide NOVARKA with SO structure oscillation ranges.

These data are required for account of mutual impact of SO and NSC structures at NSC CS-1 detailed designing effort.

NSC CS-1 Design will determine structures of the above objects to be applicable as:

- fencing structures of NSC protective facility;
- NSC internal structures to perform functions during NSC operation, in particular, to manage RAW and FCM.

Use of existing structures during construction, commissioning and operation of NSC CS-1 should not results in violation of functions performance within shut down and decommissioning of ChNPP unit No3 and OS operation.

Requirements to the fencing structures of NSC protective structure

NSC CS - 1 Design will determine:

- The new structures' loads on existing ones are assessed; these shall be minimized. In case of such loads' presence, design basis analysis of bearing capacity, stability and durability of existing structures will be executed and, if necessary, the technical solutions carried out by NOVARKA on strengthening of existing structures will be stipulated;
- Design decisions on leak tightness coupling (adjunction) of new structures of NSC fencing contour with existing ones are developed;
- Impact on bearing capacity of the foundation in the places of newly designed end-wall supports is calculated, if necessary, technical solutions carried out by NOVARKA on strengthening of the foundation will be proposed.

Requirements to the structures applicable as NSC internal arrangement

NSC CS - 1 Design will determine:

- List of existing structures of the above facilities to be used during NSC operation to perform the functions, in particular, to manage RAW and FCM;
- Concrete assignment, functions performed by the structures, terms of their operation, impact and loads on the structures.

If necessary, technical solutions carried out by the NSC CS-1 Contractor on strengthening of the structures will be foreseen.

2.4.7.1 Limit conditions for dismantling of unstable structures

2.4.7.1.1 <u>Requirements for activity on dismantling/reinforcement of unstable OS structures</u>

During the CD NSC (FS) stage the Deconstruction Evaluation Study has already been performed and the maximum freights and dimensions to be lifted specified; this provides the possibility to:

- Identify load parameters for Arch and crane designs;
- Establish the maximum dimensions of freights and their height under deconstruction; for its turn, it made possible to specify the dimensions of arch and internal laydown area dimensions;

- Establish construction debris volume, generated during dismantling. It made possible to establish the design parameters for planning.

The Employer will pass over the volume to be dismantled and design criteria for its realization to NOVARKA for taking into account the mentioned activities in NSC CS-1 Design.

2.4.7.1.2 Planned works on dismantling of unstable structures during preparation for NSC creation:

1. Interrelation of NSC works and dismantling of unstable structures.

   Planned works on dismantling of unstable structures are closely interrelated with preparation of the infrastructure created during NSC design implementation.

2. List of the LF unstable structures which will be subject to strengthening or dismantling after NSC erection

   The following issues were considered during decision-making on dismanting/ strengthening of unstable structures within CD NSC (FS):

   – Determination of dismantling or strengthening necessity;
   – Determination of dismantling sequence;
   – Determination of the basic technical decisions on dismantling technology;
   – Determination of basic technical decisions on the technology of fragmentation and decontamination of the dismantled structures;
   – Selection of the basic equipment characteristics for dismantling;
   – Selection of the main equipment for management of dismantled structures, including fragmentation, decontamination and temporary storage;
   – Determination of a basic set of rooms for management of dismantled structures;
   – Determination of issues that will be considered at the detailed designing stage.

   The dismantling sequence for unstable structures is determined in CD NSC (FS) in the following way:

   – Early dismantling of the roofing and main beams, including southern shields and shields-sticks, girders “Mammoth” and “Octopus”, and also the volumetric unit “Cat’s house”;
   – Early dismantling of internal structures, including western, eastern and additional supports of “Mammoth” beam, blockages above DS and above room 805/3, floors and structures of DS framework above Elevation +24.300;
   – Early dismantling of the roofing and main beams, including light roofing, eastern shields-sticks, volumetric unit “Dog’s house”, southern beams Б1, northern shields-sticks, volumetric unit “Mouse’s house”, northern beam Б1, pipe turn, beams Б2, beams Б3, beams Б5, panels of western shields-sticks and beams K (K1, K2).
   – Expert review of the working design on stabilization measures, the necessity of early dismantlement of beams Б1/Б2 and the upper part of western wall along Axis 50.

3. Impact of priority stabilization measures on further dismantling of unstable structures of OS and NSC.

   Stabilization Working Design realized the following stabilization measures:

   – Stabilization of structures of the western fragment (buttress wall, wall along Axis 50 with adjacent framework) - measure 2;

- Stabilization of Deaerator Stack framework above Elevation +24.000 in Axes 41-51 between Axes 41-51 Rows Б-В - measure 3b;
- Stabilization of Deaerator Stack floor slabs at Elevation 38,600 - measure 3c;
- Northern buttress wall in Row C and its junction to northern hockey-sticks - measures 5 and 11;
- Connection of southern hockey - sticks with southern panels between Axes 41-50 on Elevation +57.600 - measure 8;
- Stabilization of “Mammoth” beam western support - measure 14;
- Stabilization of “Mammoth” beam eastern support - measure 14a.

The degree of impact of stabilization measures on the dismantling of unstable structures is provided in table 2.4-4.

Table 2.4-4. Impact of stabilization measures on dismantling of OS unstable structures

Measure	Brief description	Impact on the structures subject to dismantling	Degree of impact
Measure 2	Installation of new spatial trellised metal structures consisting of two spatial tower-formed supports and spatial block-frames for perception of loading from OS roofing covering and wall unfastening on Axis 50 with adjacent framework. Supports are installed beyond buttress wall westwards.	Western roofing shields and shields-sticks	Essential impact on dismantling of the western roofing shields and shields-sticks as dismantling will be interfered by new roofing panels and spatial block-frames. It is necessary to execute additional analysis of expediency and necessity of dismantling of western roofing shields and hockey-sticks. Dismantling sequence shall be developed.
		Southern blocks of beams Б1 and Б2; Northern blocks of beams Б1 and Б2;	Degree of impact on dismantlement of beams Б1 and Б2 is insignificant
Measure 3B **(alterna-tive option)**	Stabilization of Deaerator Stack framework by installation of additional metal rods that connect heads of reinforced concrete columns on Row Б with floor at Elevation +24,300 m at Row B	Deaerator Stack framework above Elevation +24,300.	Degree of impact on dismantling of Deaerator Stack framework is insignificant. It is necessary to dismantle additional metal rods.
Measure 3c	Installation of additional metal supports under emergency plates of Deaerator Stack floor on	Deaerator Stack framework above Elevation +24,300.	Degree of impact on dismantling is insignificant. It is required to dismantle the re-installed metal

Measure	Brief description	Impact on the structures subject to dismantling	Degree of impact
	Elevation +38,600 m.		supports.
Measures 5 and 11	Installation of additional metal anchors that joint northern roofing shields-sticks with northern buttress wall and final concreting of northern buttress wall up to design elevations.	Northern roofing hockey-sticks.	Degree of impact on dismantling is insignificant. It is required to cut off the installed anchors.
Measure 8	Installation of additional metal frame that joints southern roofing shields with southern roofing shields-sticks.	Southern roofing shields and southern roofing shields-sticks.	Degree of impact on dismantling is insignificant. Technical decision allows to dismantle the re-installed frame with enlarged blocks taking into account bearing capacity of the suspended crane in NSC
Measure 14	Strengthening of vertical crosswise connections of the “Mammoth” beam western support with the help of additional corners welding.	Western support of “Mammoth” beam	Degree of impact on dismantling is insignificant as the support is dismantled without cutting into separate components.
Measure 14a	Monolithing of the “Mammoth” beam eastern support bases by arrangement of holder of metal beams, unfastened to existing columns.	Eastern support of “Mammoth” beam	Degree of impact on dismantling is insignificant, dismantle will be complicated by cutting of metal holders.

- Stabilization measures 3, 5 and 11, 14, 14a, 8 influence insignificantly on dismantling of unstable structures.
- Stabilization measure 2 impacts on dismantling of the western roofing shields and additional analysis of their dismantle expediency will be provided at the NSC Design stage.
- Employer shall revise the list of the structures subject to early dismantling during development of the CS-2 criteria taking into account review of the working design of the stabilisation measures concerning needs of early dismantling of beams B1/B2 and upper part of wall along axis 50.

2.4.7.2 Interrelation of stabilization and dismantling of structures projects with other SIP projects

During implementation of various SIP designs, coordination is necessary for all works on these designs, both at the stage of working designing and at the stage of their implementation. First of all, it will concern works on stabilization, NSC construction, dismantling/strengthening of structures, dismantling of VS-2 and construction of NVS, on creation of IAMS and execution of

works on Package D “Fuel-containing materials” (regarding strategy of FCM and RAW management and development of FCM removal technology).

When developing the NSC CS-1 design the works performed under the following projects: upgrade of physical protection system, operation of MDSS, IAMS creation and Fire protection system, preparation of the territory for contracution, shall be taken into consideration.

2.4.7.3 Dismantling and reinforcement of OS unstable structures

Development of Design on stability of unstable, but not meant for early dismantling structures, will be realized by another Contractor.

2.4.8 REQUIREMENTS FOR NSC CS-1 GENERAL LAYOUT AND TRANSPORTATION SYSTEMS

NOVARKA shall take the requirements of [1.7.32, 1.7.40] into consideration in developing the General Layout in accordance with the current construction codes and standards, the following will be designed:

- General arrangement of the NSC CS-1;
- Functional zoning of the area taking into account process ties, health and safety and fire requirements. The area will be zoned in accordance with OSPU-2005 [1.2.3] requirements;
- Shortest process and transportation links between facilities and sites;
- General engineering networks provided that the optimized and shortest links are selected;
- Integrated traffic grid for the workers;
- Vertical grading and the area relief organization taking into account the existing grading of the adjacent ChNPP Industrial Site.
- Territory improvement taking into account the existing radiation contamination.

The footprint dimensions for the NSC and General Layout will be identified considering the following:

- The NSC to be established including its components;
- Existing infrastructure facilities that are currently part of the Shelter , and those under design as part of the Shelter conversion activities;
- Additional infrastructure facilities that may be required to support FCM and radwaste strategy;
- Facilities required to support construction of NSC including the Construction Base;
- System of transportation links required to support NSC construction and operation taking into account the radwaste management;
- Engineering network system for NSC using the existing systems or establishing new ones, as required.
- Facilitation of normal operational conditions of all preserved ChNPP facilities and industry.

If certain components of technological scheme shall be taken outside the NSC, the general layout will be developed and justified, taking into account technological dependence of the auxiliary production facilities (such as, shops, yards) in relation to the NSC CS-1 (main production). Arrangement of auxiliary shops (in the existing or individual facilities) will provide for the safe evacuation of the NSC CS-1 in emergency.

The design solutions for the vertical grading and landscaping will be accompanied with the earth mass balance calculations, identification of locations for temporary and final lay-down in accordance with the contamination level.

2.5 REQUIREMENTS FOR ORGANIZATION OF CONSTRUCTION

2.5.1 GENERAL REQUIREMENTS

NOVARKA will meet the requirements of [1.7.32] and specific Shelter requirements. The Construction Plan will address the following issues

- Construction general layout for all phases of construction for NSC CS-1 including erection of underground and above ground structures, layout for: permanent structures and facilities, physical protection and access control equipment, locations for temporary buildings and facilities, structures, materials, and products, temporary sanitary barriers and sanitary locks; engineering networks, connection points for temporary engineering networks for the existing utilities showing sources for power, water, heat, steam at the construction site; storage sites; main erection cranes and other construction equipment; existing structures and those to be demolished, structure and facility benchmark locations; roads, drive ways, and access ways; fire water source locations, fire protection equipment and primary fire fighting equipment;
- Identification of principal construction, erection and special work scope showing activities related to the main structures and facilities, commissioning stages and construction phases;
- Selection and development of main methods for NSC CS-1 construction;
- Calendar schedule for all phases of construction for the NSC CS-1 to include schedule and sequence for construction of the main and auxiliary structures and facilities, technological units and stages, start-up complexes with distribution of capital investment and scope of construction for structures and facilities construction phases;
- Identification of the need for construction materials, items, structures and equipment by calendar construction phases;
- Resource Plan for construction workers by categories by each construction month;
- Manpower and collective doses;
- Identification of procedures for handling contaminated materials discovered or generated during construction;
- Identification of principal construction plant and its properties;
- Identification of the main construction phases and schedule to include sequence and schedule for the required investigations, testing, and mode surveillance to assure quality and reliability of the structures and facilities to be erected;
- Identification of the optimized structure delivery and assembly sequence;
- Other aspects on construction organization specified in section 2.5.1;
- Based on the review of the existing ChNPP capabilities, construction bases and auxiliary facilities, the additional facilities required for construction will be identified and sized;
- Guidelines for building geodetic grid basis and methods of geodetic monitoring during the construction phase;
- Proposal for establishment of industrial base of construction organization at the NSC construction site.
- Safety (radiation, fire, common industrial, ecological, labour protection, sanitary and domestic conditions, medical aid, medical and biophysical control).

The following requirements will be considered during design effort:

- Arrangement of communication and operative-dispatching control for the period of NSC construction, taking into account the complexity of facilities and specific features of the work places;
- Arrangement of decontamination of tools, equipment and transport means in accordance with the Employer procedures and regulation of Administration of Exclusion Zone;
- Appropriate measures for ensuring reserve or additional capacities for the period of construction and erection work realization.

The level of detail of the Construction Organization Plan will be adequate to support the assessment of radiological hazard for worker and environment in the EIA, SCR and SAR of NSC.

2.5.2 REQUIREMENTS FOR INFRASTRUCTURE TO REALIZE NSC

NOVARKA will be provided with Construction site to support the construction of the Safe Confinement Facility. The NSC Construction site will be located on the SO Industrial Zone. The exact location of the Construction site will be defined at a later stage; Construction site areas, additional to those defined, will be assigned following agreement with the Employer.

During development of NSC Design, NOVARKA will develop Construction Organisation Plan taking into account existing infrastructure and sites allotted for work implementation.

NOVARKA supposes the following:

- To use infrastructures established or services provided, in the framework of:
    - Small Stroybaza;
    - Change Facility for 1430 persons (CP-1430);
    - Sanitary Checkpoint (elevation +5.800);
    - Temporary laydown area at Buriakovka RWDS;
    - Training Centre and Rehabilitation Centre;
    - Utilities, Communication networks;
    - Approach Railway and Motor Roads, as required;
- To use the existing Batching Plant located close to ISF-2 building;
- To use access railway roads and unloading platforms of the Yanov Railway Station.

NOVARKA will consider the information related to:

- Weight and dimension characteristics of structures being fabricated at the specialized Ukrainian plants,
- List of structures fabricated at the Stroybaza,
- Degree of the "Arch" structural element enlargement at the NSC Construction site and Pre-Assembly Site,
- Methods of structure delivery from NSC Construction site to the Pre-Assembly Site,
- Equipment of NSC Construction site and Pre-Assembly Site with handling facilities and bench-test equipment.

NOVARKA will prepare site facilities related to NSC construction such as:

- Temporary buildings and facilities for the personnel (offices for builders, erectors and officials of NOVARKA, etc.);
- Internal roads for delivery of materials and equipment;
- Railways and port facilities, situated at the ChNPP, in Pripyat and Chernobyl towns to assist in delivery of equipment and materials for NSC, if needed by NOVARKA;
- Facilities for the NSC personnel training;
- Sites for work implementation;
- Temporary Sanitary Barriers and sanitary locks;
- Storage/warehousing sites for NSC equipment and materials;
- Armature storage;
- Catering facilities for personnel;
- Storage of combustion lubricative materials;
- Compressor house.

NOVARKA envisions performing engineering surveys (geotechnical, radiological, etc.).

NOVARKA will describe in Construction Organization Plan in addition to the requirements stated in Section 2.5.1 the following issues:

- Delivery of bulky steel tube structures of large diameter;
- Delivery of prefabricated concrete reinforced structures;
- Delivery of materials for construction (concrete, sand, fasting, armature, etc.);
- Electric power supply;
- Water supply;
- Firewater supply;
- Heating supply;
- Sewage (storm and consumer);
- Departure of generated RAW;
- Departure of domestic waste;
- Sanitary and domestic services of construction personnel;
- Provision of radiation monitoring system with required nomenclature.

Geographically, NOVARKA plans to install the infrastructure facilities in the Small Stroybasa (handed over by ChNPP), trapezoidal base located south of the Industrial Zone for the pre-assembly of arch structure, on the site and nearby the batching plant used for ISF-2 construction and other areas. The definitive allocation of the infrastructure will rely on the radiological and ground surveys to be carried out upon completion of CDSD. These surveys will determine if working in these areas meets the sanitary requirements.

The following figures present the geographic location of the Arch Assembly and transfer areas.

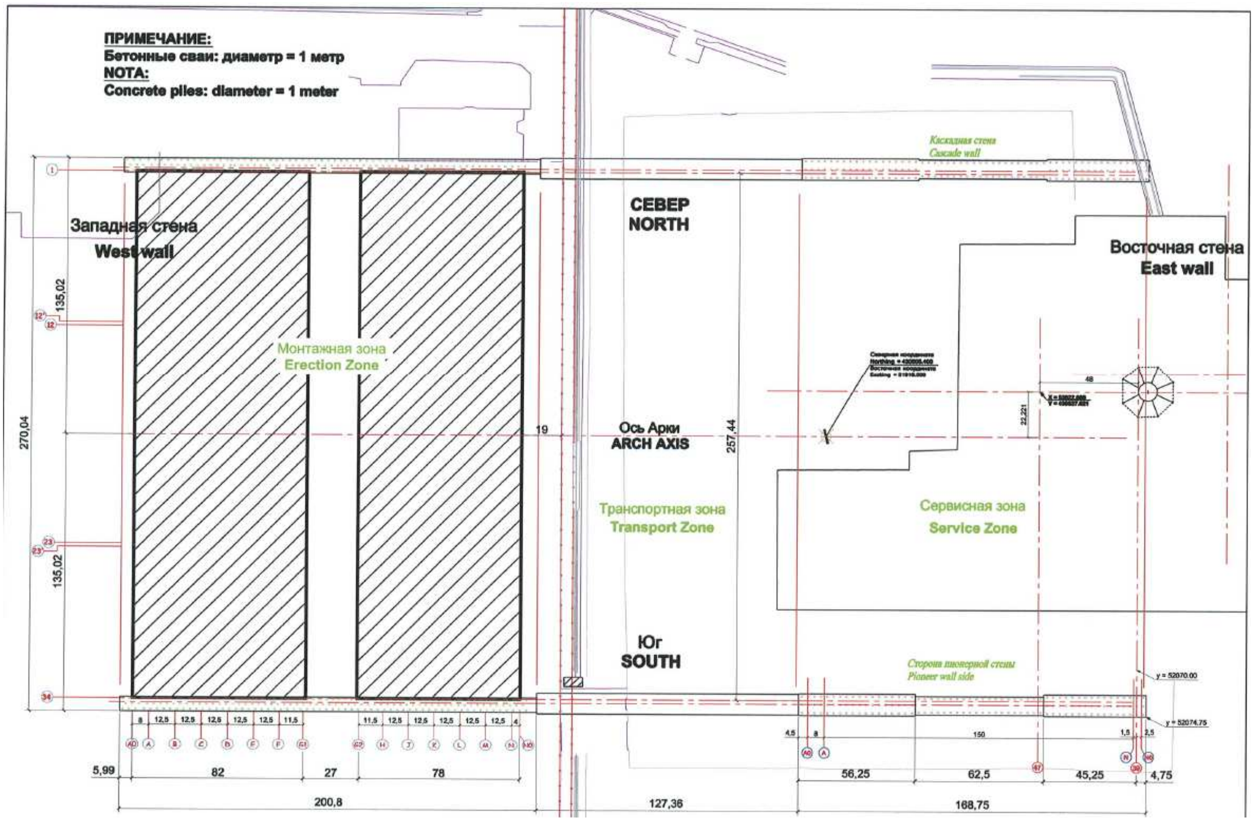


Figure 2.5-1. geographic location of the Arch Assembly and transfer areas.

2.5.3 DESIGN CRITERIA FOR THE RESTRICTION OF POWER IMPACT TO THE SO BUILDING STRUCTURE DURING NSC CS-1 CONSTRUCTION

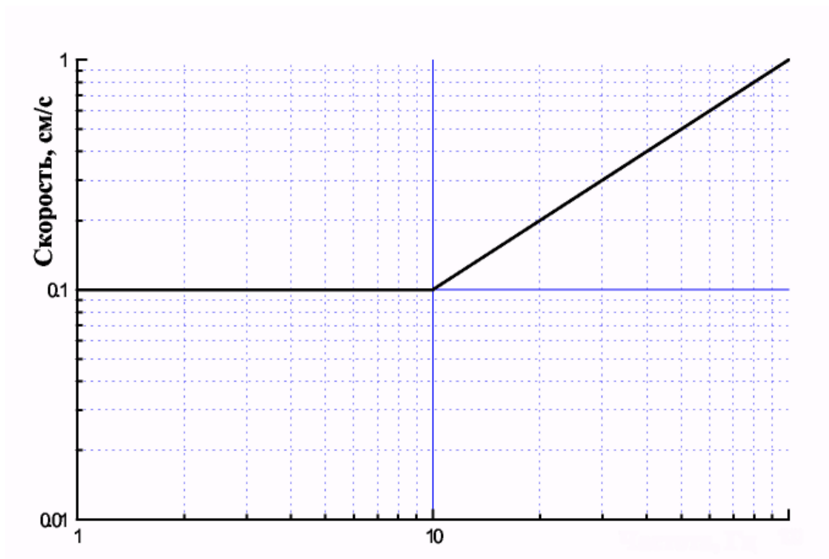


Figure 2.5-2. Admissible levels of vibrospeed for OS foundations

According to the Technical Decision (TD) on “Design Criteria to Limit Power Loads on the Building Structures of the “Shelter” Object during Commissioning Stage-1 NSC Construction”, the following actions were defined:

1. Accept the conservative approach to limitation of dynamic effects onto OS elements. For all OS elements, accept the allowed level of vibro-speed, which does not exceed the values in graph of dependence between the allowed level of vibro-speed and frequency:
   - Within the frequency range 1÷10 Hz ≤ 1,0 mm/sec.;
   - Within the frequency range 10÷20 Hz ≤ 1,0 - 2,0 mm/sec.;
   - Within the frequency range 20÷40 Hz ≤ 2,0 - 4,0 mm/sec.;
   - Within the frequency range 40÷100 Hz ≤ 4,0 - 10,0 mm/sec.;
2. The NSC SC-1 Construction and NSC preparatory works Contractors shall provide evidence in the design (by calculations or proposed control and monitoring system) that the vibrations, expected for the period of construction and operation of the facilities, will not cause the exceeding of levels of permissible vibration velocities for OS elements shown in i.1, and OS basis settlement will not exceed the values shown in Table 2 of the aforementioned TD.

2.5.4 PRELIMINARY CRITERIA OF ADMISSIBLE LEVELS OF OS BASIS SETTLEMENTS

On According to the Technical Decision on “Approval of Design Criteria to Limit Power Loads on the Structures of the “Shelter” Object during Commissioning Stage-1 NSC Construction” [1.12.20], the following was defined:

The NSC SC-1 Design and Construction and NSC preparatory works Contractors shall provide evidence in the design (by calculations or proposed control and monitoring system) that the expected settlements of bases will not exceed the ones presented in Table 2.5.-1.

Table 2.5-1. Permissible values of settlement of the ASRU unit and OS base

STRUCTURE LOCATION	STRUCTURE DESCRIPTION	SETTLEMENT VALUE NOT MORE THAN [mm]
North	ASRU unit (Ю row settlement against row У)	12.0
	Extreme northern edge of the northern Cascade Wall (edge settlement against row У)	4.0
South	Turbine Hall frame (row A settlement against row Б)	204.0
West	DS frame northern edge from axes 51 to axes 68 (row B1 settlement against row Б)	32.1

Note to Table 2.5-1.: The values allowed for foundation settlements will be specified after measuring the geometry of buildings. The predicted correction values are: for turbine hall and DS -10%, for NIAS +16%, for the North cascade wall +50%.

2.5.5 ACCESS TO OBJECT SHELTER

The following normal entrances\exits for personnel access to DS OS from the northern side are available:

- № 132 from annex to OS at elevation +6.000, row B_1 between axes 67-68;
- № 139 from annex to OS at elevation +10.000 from the end of DS between rows B and B_1 in axis 68;
- № 131 at the elevation +6.000, row B_1 between axes 59-60.

Entrances/exits № 132 and 139 are considered conditionally clean, and entrance/exit # 131 – conditionally contaminated.

Entrances/exits to OS annex are located:

- Normal: at elevation +6.000, row B between axes 68_{-1000} – 68_{-2000} (it will be located outside the Arch);
- Emergency: at elevation +6.000, axis 64_{-4660} and rows B_1 and B_{+2500} (it will be located at sub-arch area).

The following normal entrances/exits from southern area for personnel access to Turbine Hall, from axis 40 to axis 68, which is the part of OS, row A from top of pioneer wall are available:

- № 134 is located between axes 58-59;
- № 135 is located between axes 47-48;
- № 136 is located between axes 38-39.

They are normal emergency passes.

From Unit №3 there is normal entrance/exit to OS #130. It is located between rows B_1 – B_{-8000} and axes 39_{+3000} – 41.

Portal monitors of personnel access control system are installed at this pass.

Exit to Unit Б roofing can be carried out as follows:

- At elevation +61.000 from Room № 6004;
- With the help of cargo-and-passenger elevator from elevation +10.000, row C in axes 53 - 54;
- With the help of staircases in rows P-C in axes 53 – 54 to elevation +54.9m;
- With the help of cargo-and-passenger elevator from elevation +14.000, between rows П-Н in axes 54 – 55;
- With the help of two metal stairs, height 47.3 m each, located at rows Ж and П on foundations of reinforced metal structures at elevation +14.000.

Cargo-and-passenger elevator, located along row C along axis 57, is fastened to Western Buttress Wall.

Cargo-and-passenger elevator, located between rows П-Н along axis 57, is fastened to Northern reinforced metal structures of beams Б1 and Б2.

Two metal ladder units are installed for lifting to metal ladders, located at rows Ж and П from elevation +6.000 m to elevation +14.000 m.

Exit to Turbine Hall roofing can be realized as follows:

- With the help of cargo-and-passenger elevator located between axes 43-44 near Turbine Hall wall along row A;
- With the help of external metal fire ladder, located along row A, axis 45, from elevation +10.100 to elevation +40.880 m and in axes 59-60 from elevation +10.5 m to elevation +34.93 m.

Workers have access to Western and Eastern Mammoth Beam Supports through Turbine Hall landings between rows A and Б, at axes 44 – 50 to doors in apertures in Southern shields-hockey sticks.

More thorough description of personnel routes to work areas inside OS and emergency personnel escape routes are presented in document [3.27].

After dismantling of the western fence of LA and KPP-4, KPP-5 it will be necessary to organize access ways to OS.

New personnel routes [2.6.10] inside OS and NSC will be defined in accordance with the following:

- Arrangement of internal facility areas,
- Room zoning based on radiological risk factors,
- Necessity to move from one area to another,
- Compliance with regulations for fire safety and emergency escape routes for personnel.

It is recommended to keep access to OS (as it is now, without changing current procedures and access control units):

- Access of personnel who work inside OS including the local area will be made through the current access control routes. After sanitary lock at elevation +5.800 access to OS work areas will be permitted through the current routes;
- Access of personnel who work at NSC construction site (OS industrial site) will be permitted through sanitary lock СП-1430.

In OS rooms, equipment and tools can be delivered to work areas only manually. Personnel routes through OS corridors and stairwells make impossible to transport equipment due to the following:

- Design width of corridor along major personnel routes has been significantly reduced for different equipment, which was installed after the accident and in certain corridors the width varies from 0.8 m to 1m;
- Certain rooms can be reached by using metal vertical ladder, which width varies from 0.6m to 0.8m;
- Certain rooms packed with different materials and equipment.

The new personnel access routes to OS and NSC will be presented in WEP and in the Safe Work Execution Programme.

2.6 REQUIREMENTS AND CRITERIA FOR ASSURANCE OF NUCLEAR AND RADIOLOGICAL SAFETY

2.6.1 REQUIREMENTS AND RADIOLOGICAL SAFETY CRITERIA

NSC will be compliant with radiation safety requirements; at that, its radiation impact on personnel, public and the environment will not lead to excess of exposure dose limits for personnel and public, norms for releases, discharges and content of radioactive substances in the environment under normal operation, emergencies and design accidents as well as if it is limited during beyond-the-design accidents. The required measures on minimization of the additional radioactive contamination of the environment (within the contamination levels established for Exclusion Zone) will be implemented during NSC operation.

The main documents defining radiation safety criteria in Ukraine are the “Norms of Radiation Safety in Ukraine” (НРБУ-97) [1.2.1], “Radiological Protection from the Sources of Potential Exposure” (НРБУ-97/Д-2000) [1.2.2] and “Basic Sanitary Rules for Radiological Protection of Ukraine (ОСПУ-2005) [1.2.3].

2.6.1.1 Radiological safety during normal operation of the NSC

All NSC operation staff are designated as Category A personnel. Their radiation protection during the normal NSC operation will be ensured by observance of the Group 1 regulations per [1.2.1].

During development of activities on radiological safety assurance it is necessary to consider that in accordance with OSPU-2005, the design of protection of personnel from the exposure, including protection of rooms attended by the personnel on a periodical basis or during implementation of repair activities, shall be performed with the assurance factor 2 for annual effective and equivalent doses of the current and potential exposure [1.2.1, 1.2.3].

During development of the Design, in the process of the development of technical specifications, containing initial requirements and data of NOVARKA to be considered by the CS-2 Contractor, it will be proposed that design engineering solutions take into account, in particular, possible impacts in terms of dust release at NSC CS-1 SSC and radiation exposure dose as a result of NSC CS-2 activities on NSC CS-1.

The Design will provide the appropriate calculations and justifications for the NSC CS-2 impact, as well as its acceptability, taking into account changes in external exposure dose during the execution of work. Also, the technical solutions for their reduction shall be proposed.

The activities on Radiological Safety assurance will be developed in accordance with the Sanitary Regulations [1.2.3] for all stages of NSC CS-1 and CS-2 construction and operation.

In calculating doses and developing recommendations for radiological protection, it is necessary to consider the following:

- The changes in radiological conditions due to possible changing parameters of the γ-radiation interfacing with the NSC CS-1 structural members;
- Concentration of radioactive aerosols in air owing to works;
- Probable contamination of structures and materials;
- The technological processes taking place, including those of NSC CS-2;

- Solutions on screening.

At this, it is required to consider the conservative change of radiation environment inside the NSC within the period and after deconstruction of the OS unstable structures. In order to update available initial data, after commissioning, the initial status after NSC sliding will need assessment by the Employer using NSC CS-1 equipment, for instance the main cranes.

The following will be considered during protection design of NSC CS-1:

- Purpose of rooms, territories, and their location;
- Category of exposed personnel and forecasted stay duration in the exposure zone;
- Availability of all ionizing radiation sources impacting personnel subject to exposure, including the CS-2;
- Dynamics of radiological condition change in the process of work performance, taking into account the OS disassembly and FCM removal designed according to the calculated level of performance of the NSC and its systems (ventilation system, crane system…);
- Absorption of radioactive substances by the structural materials.

The Design will determine a special complex of measures according to sanitary legislation requirements and the complex activities on radiological safety, including in particular:

- Zoning;
- Technical activities (shielding, dust suppression, decontamination, etc.);
- Personal protection equipment;
- Radiation monitoring;
- Estimation of quota for NSC CS-2 releases and discharges.

Permissible radiation levels at personnel work places are established in the document «Design permissible levels for the NSC» [1.2.6].

The radiation situation change in the NSC in the result of dismantling of the OS unstable structures (first of all, pipe roofing over the Reactor Hall) will be considered.

2.6.1.1.1 <u>Zoning of Rooms</u>

Zoning will comply with the requirements [1.2.3]. Some requirements [1.2.3] are detailed in [2.1.1]. Application of [2.1.1] will be adapted for concrete conditions of NSC thus [1.2.3] will be used as basic document and [2.1.1] - as auxiliary one. In Appendix A2.3 the basic requirements from [1.2.3] and [2.1.1] are provided.

NOVARKA will justify radiation-hygienic zoning of all NSC CS-1 rooms in accordance with [1.2.3]:

- Zone 1 – Unattended rooms;
- Zone 2 – Periodically attended rooms;
- Zone 3 – Permanently attended rooms.

The permanently attended rooms (Zone 3) shall be located at the maximum possible distance from the main exposure sources, i.e., in the places with the most favourable radiological conditions

The acceptable design indicators of radiation parameters (acceptable design levels - ADL) for work places (WP) groups of NSC operating staff are provided in [2.1.1]. These norms will be used during designing. At ADL definition in [2.1.1] the assurance factor 2 is used, that is

regulated by [1.2.3] for designing of radiation protection. During evaluation of protective measurements, the calculated design values of the parameters with ADL provided further from [2.1.1] will be compared. As [2.1.1] already use assurance factor – 2, at calculations of design parameters of radiation parameters the factor will not be used.

The following groups of WP will be established:

- WP of group 1 − WP of temporary presence of the operation personnel in zones and premises where main ionizing sources and/or radioactive contamination are located. The presence of the personnel in these WP is permitted only in special cases, for example, if equipment needs repair (check-up), some technological operations need to be implemented in Shelter zones and premises, not normally occupied. WP of group 1 includes places of works or operations execution and routes of the personnel movement to them within borders of zones and premises mentioned. ADL are established for these WP depending on time of the personnel presence in them and, taking into account the personnel use of respiratory personal protection equipment (RIPM), respirators or insulating RPPE;
- WP of group 2 - all WP, except for WP of group 1 and 3. WP of group 2, located within borders of NSC protective structure include places of works or operations execution and routes of the personnel movement within the borders of NSC protective structure. ADL are established for these WP depending on time of the personnel presence in them and taking into account the personnel use of respirators (insulating RPPE are not used);
- WP of group 3 − WP of permanent presence of the personnel within the borders of NSC protective structure and WP outside this structure at which during NSC operation execution of works or operations with radioactive substances is not stipulated. WP of group 3, situated within borders of NSC protective structure includes places of works or operations execution and routes of the personnel movement within the borders of NSC protective structure. ADL are established for these WP taking into account the personnel permanent presence without use of RPPE.

Design acceptable levels for WP of group 1

It is established ADL of dose rate of external radiation ($\mathbf{PDR_1^P}$) and concentration of radioactive aerosols for α- and β-radiation radionuclides in the air (accordingly, $\mathbf{PC_{\alpha 1}^P}$ and $\mathbf{PC_{\beta 1}^P}$).

The inequality must be true:

$$\frac{C_{\alpha 1}}{PC_{\alpha 1}^P} + \frac{C_{\beta 1}}{PC_{\beta 1}^P} + \frac{\dot{E}_{ext,1}}{PDR_1^P} \leq 1 - 2\,\frac{\tilde{\mathrm{E}}_1}{\mathrm{DL_E}} \qquad (2.6.1)$$

Where:

- $\mathbf{C_{\alpha 1}}$ ($\mathbf{C_{\beta 1}}$) – calculation design values of concentrations of α− (β−) radiation radionuclides in the air of WP of group 1. The average weighted value for the time of personnel stay in WP is calculated;
- $\dot{E}_{ext,1}$ – calculation design value of dose rate of external radiation at PM of group 1. The average weighted value for the time of personnel stay in WP is calculated;
- $\tilde{E}_1$ – calculation design value of effective dose that the personnel will get during calendar year except for the execution of planned works at WP of group 1;
- $\mathbf{DL_E}$ – limit of effective dose for the personnel of category A, DL_E = 20 mSv.

Values of $PC_{\alpha 1}^{P}$, $PC_{\beta 1}^{P}$ and PDR_{1}^{P} are indicated in Table 2.6-1. One of the variants indicated in the table needs to be chosen, in accordance with:

- Planned presence of the personnel at WP. In case of absence in the table of a line that meets the planned presence of the personnel at WP the line with the closest value of time that exceeds the planned one shall be chosen;
- Planned RPPE use;
- Works categories (by physical loading);
- Presence/absence of local sources.

Design rates of surface contamination, caused by α- and β- radiation radionuclides, and radiation protection systems (such as ventilation, dust suppression, decontamination, shielding) under design, must assure no exceeding of $PC_{\alpha 1}^{P}$ $PC_{\beta 1}^{P}$, PDR_{1}^{P} numerical values (presented in Table 2.6-1) in implementing the work at WP of group 1.

Design acceptable levels for WP of group 2

ADL of dose rate of external radiation (PDR_{2}^{P}) and concentration of radioactive aerosols for α- and β-radiation radionuclides in the air (accordingly, $PC_{\alpha 2}^{P}$ and $PC_{\beta 2}^{P}$) are established.

The inequality must be true:

$$\frac{C_{\alpha 2}}{PC_{\alpha 2}^{P}} + \frac{C_{\beta 2}}{PC_{\beta 2}^{P}} + \frac{\dot{E}_{ext,2}}{PDR_{2}^{P}} \leq 1 - 2\frac{\tilde{E}_{2}}{DL_{E}} \quad (2.6.2)$$

Where:

- **$C_{\alpha 2}$ ($C_{\beta 2}$)** – calculation design values of concentrations of α− (β−) radiation radionuclides in the air of WP of group 2;
- $\dot{\mathbf{E}}_{\mathbf{ext,2}}$ – calculation design value of dose rate of external radiation at PM of group 2. The average weighted value for the time of personnel stay in WP is calculated;
- $\tilde{\mathbf{E}}_{\mathbf{2}}$ – calculation design value of effective dose that the personnel will get during a calendar year except for his execution of planned works at WP of group 2. The average weighted value for the time of personnel stay in WP is calculated;
- **DL_E** – limit of effective dose for the personnel of category A, DL_E = 20 mSv.

Values of $\mathbf{PC_{\alpha 2}^{P}}$, $\mathbf{PC_{\beta 2}^{P}}$ and $\mathbf{PDR_{2}^{P}}$ are indicated in Table 2.6-2. One of the variants indicated in the table will be chosen, in accordance with:

- Planned presence of the personnel at WP. If there is no line in the table that meets the planned presence of the personnel at WP the line with the closest value of time that exceeds the planned one shall be chosen;
- Works categories (by physical loading);
- Presence/absence of local sources.

Table 2.6-1. Values of $PC^{P}_{\alpha1}$, $PC^{P}_{\beta1}$ and PDR^{P}_{1} for WP of group 1

Time of the personnel presence on WP, hours	*Use of respirators*				*Use of isolating RIPM*				*Local sources are absent*	*Local sources are present*
	Category of works II		*Category of works III*		*Category of works II*		*Category of works III*			
	$PC^{P}_{\alpha1}$, *Bq·m⁻³*	$PC^{P}_{\beta1}$, *Bq·m⁻³*	$PC^{P}_{\alpha1}$, *Bq·m⁻³*	$PC^{P}_{\beta1}$, *Bq·m⁻³*	$PC^{P}_{\alpha1}$, *Bq·m⁻³*	$PC^{P}_{\beta1}$, *Bq·m⁻³*	$PC^{P}_{\alpha1}$, *Bq·m⁻³*	$PC^{P}_{\beta1}$, *Bq·m⁻³*	PDR^{P}_{1}, *mR·h⁻¹*	PDR^{P}_{1} *mR·h⁻¹*
0,1	$1,9\cdot10^{4}$	$5,8\cdot10^{6}$	$1,1\cdot10^{4}$	$3,7\cdot10^{6}$	$9,6\cdot10^{5}$	$2,9\cdot10^{8}$	$5,7\cdot10^{5}$	$1,8\cdot10^{8}$	$1,6\cdot10^{4}$	$9,0\cdot10^{3}$
0,2	$9,6\cdot10^{3}$	$2,9\cdot10^{6}$	$5,7\cdot10^{3}$	$1,8\cdot10^{6}$	$4,8\cdot10^{5}$	$1,5\cdot10^{8}$	$2,8\cdot10^{5}$	$9,2\cdot10^{7}$	$8,1\cdot10^{3}$	$4,5\cdot10^{3}$
0,3	$6,4\cdot10^{3}$	$1,9\cdot10^{6}$	$3,8\cdot10^{3}$	$1,2\cdot10^{6}$	$3,2\cdot10^{5}$	$9,7\cdot10^{7}$	$1,9\cdot10^{5}$	$6,1\cdot10^{7}$	$5,4\cdot10^{3}$	$3,0\cdot10^{3}$
0,4	$4,8\cdot10^{3}$	$1,5\cdot10^{6}$	$2,8\cdot10^{3}$	$9,1\cdot10^{5}$	$2,4\cdot10^{5}$	$7,3\cdot10^{7}$	$1,4\cdot10^{5}$	$4,6\cdot10^{7}$	$4,0\cdot10^{3}$	$2,2\cdot10^{3}$
0,5	$3,8\cdot10^{3}$	$1,2\cdot10^{6}$	$2,3\cdot10^{3}$	$7,3\cdot10^{5}$	$1,9\cdot10^{5}$	$5,8\cdot10^{7}$	$1,1\cdot10^{5}$	$3,7\cdot10^{7}$	$3,2\cdot10^{4}$	$1,8\cdot10^{3}$
0,6	$3,2\cdot10^{3}$	$9,7\cdot10^{5}$	$1,9\cdot10^{3}$	$6,1\cdot10^{5}$	$1,6\cdot10^{5}$	$4,9\cdot10^{7}$	$9,6\cdot10^{4}$	$3,1\cdot10^{7}$	$2,7\cdot10^{3}$	$1,5\cdot10^{3}$
0,7	$2,7\cdot10^{3}$	$8,3\cdot10^{5}$	$1,6\cdot10^{3}$	$5,2\cdot10^{5}$	$1,3\cdot10^{5}$	$4,2\cdot10^{7}$	$8,2\cdot10^{4}$	$2,6\cdot10^{7}$	$2,3\cdot10^{3}$	$1,2\cdot10^{3}$
0,8	$2,4\cdot10^{3}$	$7,2\cdot10^{5}$	$1,4\cdot10^{3}$	$4,5\cdot10^{5}$	$1,2\cdot10^{5}$	$3,6\cdot10^{7}$	$7,2\cdot10^{4}$	$2,3\cdot10^{7}$	$2,0\cdot10^{3}$	$1,1\cdot10^{3}$
0,9	$2,1\cdot10^{3}$	$6,4\cdot10^{5}$	$1,2\cdot10^{3}$	$4,0\cdot10^{5}$	$1,0\cdot10^{5}$	$3,2\cdot10^{7}$	$6,4\cdot10^{4}$	$2,0\cdot10^{7}$	$1,8\cdot10^{3}$	$1,0\cdot10^{3}$
1,0	$1,9\cdot10^{3}$	$5,8\cdot10^{5}$	$1,1\cdot10^{3}$	$3,6\cdot10^{5}$	$9,6\cdot10^{4}$	$2,9\cdot10^{7}$	$5,7\cdot10^{4}$	$1,8\cdot10^{7}$	$1,6\cdot10^{3}$	$9,0\cdot10^{2}$
1,5	$1,2\cdot10^{3}$	$3,8\cdot10^{5}$	$7,7\cdot10^{2}$	$2,4\cdot10^{5}$	$6,4\cdot10^{4}$	$1,9\cdot10^{7}$	$3,8\cdot10^{4}$	$1,2\cdot10^{7}$	$1,0\cdot10^{3}$	$6,0\cdot10^{2}$
2	$9,6\cdot10^{2}$	$2,9\cdot10^{5}$	$5,7\cdot10^{2}$	$1,8\cdot10^{5}$	$4,8\cdot10^{4}$	$1,5\cdot10^{7}$	$2,8\cdot10^{4}$	$9,2\cdot10^{6}$	$8,1\cdot10^{2}$	$4,5\cdot10^{2}$
2,5	$7,7\cdot10^{2}$	$2,3\cdot10^{5}$	$4,6\cdot10^{2}$	$1,4\cdot10^{5}$	$3,8\cdot10^{4}$	$1,2\cdot10^{7}$	$2,3\cdot10^{4}$	$7,4\cdot10^{6}$	$6,5\cdot10^{2}$	$3,6\cdot10^{2}$
3	$6,4\cdot10^{2}$	$1,9\cdot10^{5}$	$3,8\cdot10^{2}$	$1,2\cdot10^{5}$	$3,2\cdot10^{4}$	$9,7\cdot10^{6}$	$1,9\cdot10^{4}$	$6,1\cdot10^{6}$	$5,4\cdot10^{2}$	$3,0\cdot10^{2}$
3,5	$5,5\cdot10^{2}$	$1,6\cdot10^{5}$	$3,3\cdot10^{2}$	$1,0\cdot10^{5}$	$2,7\cdot10^{4}$	$8,3\cdot10^{6}$	$1,6\cdot10^{4}$	$5,3\cdot10^{6}$	$4,6\cdot10^{2}$	$2,5\cdot10^{2}$
4	$4,8\cdot10^{2}$	$1,4\cdot10^{5}$	$2,8\cdot10^{2}$	$9,1\cdot10^{4}$	$2,4\cdot10^{4}$	$7,3\cdot10^{6}$	$1,4\cdot10^{4}$	$4,6\cdot10^{6}$	$4,0\cdot10^{2}$	$2,2\cdot10^{2}$
4,5	$4,3\cdot10^{2}$	$1,2\cdot10^{5}$	$2,5\cdot10^{2}$	$8,1\cdot10^{4}$	$2,1\cdot10^{4}$	$6,5\cdot10^{6}$	$1,2\cdot10^{4}$	$4,1\cdot10^{6}$	$3,6\cdot10^{2}$	$2,0\cdot10^{2}$
5	$3,8\cdot10^{2}$	$1,1\cdot10^{5}$	$2,3\cdot10^{2}$	$7,3\cdot10^{4}$	$1,9\cdot10^{4}$	$5,8\cdot10^{6}$	$1,1\cdot10^{4}$	$3,7\cdot10^{6}$	$3,2\cdot10^{2}$	$1,8\cdot10^{2}$
6	$3,2\cdot10^{2}$	$9,7\cdot10^{4}$	$1,9\cdot10^{2}$	$6,1\cdot10^{4}$	$1,6\cdot10^{4}$	$4,9\cdot10^{6}$	$9,6\cdot10^{3}$	$3,1\cdot10^{6}$	$2,7\cdot10^{2}$	$1,5\cdot10^{2}$
7	$2,7\cdot10^{2}$	$8,3\cdot10^{4}$	$1,6\cdot10^{2}$	$5,2\cdot10^{4}$	$1,3\cdot10^{4}$	$4,2\cdot10^{6}$	$8,2\cdot10^{3}$	$2,6\cdot10^{6}$	$2,3\cdot10^{2}$	$1,2\cdot10^{2}$
8	$2,4\cdot10^{2}$	$7,2\cdot10^{4}$	$1,4\cdot10^{2}$	$4,5\cdot10^{4}$	$1,2\cdot10^{4}$	$3,6\cdot10^{6}$	$7,2\cdot10^{3}$	$2,3\cdot10^{6}$	$2,0\cdot10^{2}$	$1,1\cdot10^{2}$
9	$2,1\cdot10^{2}$	$6,4\cdot10^{4}$	$1,2\cdot10^{2}$	$4,0\cdot10^{4}$	$1,0\cdot10^{4}$	$3,2\cdot10^{6}$	$6,4\cdot10^{3}$	$2,0\cdot10^{6}$	$1,8\cdot10^{2}$	$1,0\cdot10^{2}$
10	$1,9\cdot10^{2}$	$5,8\cdot10^{4}$	$1,1\cdot10^{2}$	$3,6\cdot10^{4}$	$9,6\cdot10^{3}$	$2,9\cdot10^{6}$	$5,7\cdot10^{3}$	$1,8\cdot10^{6}$	$1,6\cdot10^{2}$	90
15	$1,2\cdot10^{2}$	$3,8\cdot10^{4}$	77	$2,4\cdot10^{4}$	$6,4\cdot10^{3}$	$1,9\cdot10^{6}$	$3,8\cdot10^{3}$	$1,2\cdot10^{6}$	$1,0\cdot10^{2}$	60

Time of the personnel presence on WP, hours	***Use of respirators***				***Use of isolating RIPM***				***Local sources are absent***	***Local sources are present***
	Category of works II		***Category of works III***		***Category of works II***		***Category of works III***			
	$PC^{P}_{\alpha 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\beta 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\alpha 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\beta 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\alpha 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\beta 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\alpha 1}$, *Bq·m*$^{-3}$	$PC^{P}_{\beta 1}$, *Bq·m*$^{-3}$	PDR^{P}_{1}, *mR·h*$^{-1}$	PDR^{P}_{1} *mR·h*$^{-1}$
20	96	$2,9\cdot10^{4}$	57	$1,8\cdot10^{4}$	$4,8\cdot10^{3}$	$1,5\cdot10^{6}$	$2,8\cdot10^{3}$	$9,1\cdot10^{5}$	81	45
25	77	$2,3\cdot10^{4}$	46	$1,4\cdot10^{4}$	$3,8\cdot10^{3}$	$1,2\cdot10^{6}$	$2,3\cdot10^{3}$	$7,3\cdot10^{5}$	65	36
30	64	$1,9\cdot10^{4}$	38	$1,2\cdot10^{4}$	$3,2\cdot10^{3}$	$9,7\cdot10^{5}$	$1,9\cdot10^{3}$	$6,1\cdot10^{5}$	54	30
35	55	$1,6\cdot10^{4}$	33	$1,0\cdot10^{4}$	$2,7\cdot10^{3}$	$8,3\cdot10^{5}$	$1,6\cdot10^{3}$	$5,2\cdot10^{5}$	46	25
40	48	$1,4\cdot10^{4}$	28	$9,1\cdot10^{3}$	$2,4\cdot10^{3}$	$7,2\cdot10^{5}$	$1,4\cdot10^{3}$	$4,5\cdot10^{5}$	40	22
45	43	$1,2\cdot10^{4}$	25	$8,1\cdot10^{3}$	$2,1\cdot10^{3}$	$6,4\cdot10^{5}$	$1,2\cdot10^{3}$	$4,0\cdot10^{5}$	36	20
50	38	$1,1\cdot10^{4}$	23	$7,3\cdot10^{3}$	$1,9\cdot10^{3}$	$5,8\cdot10^{5}$	$1,1\cdot10^{3}$	$3,6\cdot10^{5}$	32	18
60	32	$9,7\cdot10^{3}$	19	$6,1\cdot10^{3}$	$1,6\cdot10^{3}$	$4,8\cdot10^{5}$	$9,6\cdot10^{2}$	$3,0\cdot10^{5}$	27	15
70	27	$8,3\cdot10^{3}$	16	$5,2\cdot10^{3}$	$1,3\cdot10^{3}$	$4,1\cdot10^{5}$	$8,2\cdot10^{2}$	$2,6\cdot10^{5}$	23	12
80	24	$7,2\cdot10^{3}$	14	$4,5\cdot10^{3}$	$1,2\cdot10^{3}$	$3,6\cdot10^{5}$	$7,2\cdot10^{2}$	$2,2\cdot10^{5}$	20	11
90	21	$6,4\cdot10^{3}$	12	$4,0\cdot10^{3}$	$1,0\cdot10^{3}$	$3,2\cdot10^{5}$	$6,4\cdot10^{2}$	$2,0\cdot10^{5}$	18	10
100	19	$5,8\cdot10^{3}$	11	$3,6\cdot10^{3}$	$9,6\cdot10^{2}$	$2,9\cdot10^{5}$	$5,7\cdot10^{2}$	$1,8\cdot10^{5}$	16	9,0
120	16	$4,8\cdot10^{3}$	9,6	$3,0\cdot10^{3}$	$8,0\cdot10^{2}$	$2,4\cdot10^{5}$	$4,8\cdot10^{2}$	$1,5\cdot10^{5}$	13	7,5
140	13	$4,1\cdot10^{3}$	8,2	$2,6\cdot10^{3}$	$6,9\cdot10^{2}$	$2,0\cdot10^{5}$	$4,1\cdot10^{2}$	$1,3\cdot10^{5}$	11	6,4
160	12	$3,6\cdot10^{3}$	7,2	$2,2\cdot10^{3}$	$6,0\cdot10^{2}$	$1,8\cdot10^{5}$	$3,6\cdot10^{2}$	$1,1\cdot10^{5}$	10	5,6
180	10	$3,2\cdot10^{3}$	6,4	$2,0\cdot10^{3}$	$5,3\cdot10^{2}$	$1,6\cdot10^{5}$	$3,2\cdot10^{2}$	$1,0\cdot10^{5}$	9,1	5,0
200	9,6	$2,9\cdot10^{3}$	5,7	$1,8\cdot10^{3}$	$4,8\cdot10^{2}$	$1,4\cdot10^{5}$	$2,8\cdot10^{2}$	$9,1\cdot10^{4}$	8,1	4,5

Table 2.6-2. Values of $PC_{\alpha2}^{P}$, $PC_{\beta2}^{P}$ and PDR_{2}^{P} for WP of group 2

Time of the personnel presence on WP, hours	Use of respirators				Local sources are absent PDR_{2}^{P}, mR·h^{-1}	Local sources are present PDR_{2}^{P}, mR·h^{-1}
	Category of works II		Category of works III			
	$PC_{\alpha2}^{P}$, Bq·m^{-3}	$PC_{\beta2}^{P}$, Bq·m^{-3}	$PC_{\alpha2}^{P}$, Bq·m^{-3}	$PC_{\beta2}^{P}$, Bq·m^{-3}		
1,0	1,9·10^{3}	5,8·10^{5}	1,1·10^{3}	3,6·10^{5}	1,6·10^{3}	9,0·10^{2}
1,5	1,2·10^{3}	3,8·10^{5}	7,7·10^{2}	2,4·10^{5}	1,0·10^{3}	6,0·10^{2}
2	9,6·10^{2}	2,9·10^{5}	5,7·10^{2}	1,8·10^{5}	8,1·10^{2}	4,5·10^{2}
2,5	7,7·10^{2}	2,3·10^{5}	4,6·10^{2}	1,4·10^{5}	6,5·10^{2}	3,6·10^{2}
3	6,4·10^{2}	1,9·10^{5}	3,8·10^{2}	1,2·10^{5}	5,4·10^{2}	3,0·10^{2}
3,5	5,5·10^{2}	1,6·10^{5}	3,3·10^{2}	1,0·10^{5}	4,6·10^{2}	2,5·10^{2}
4	4,8·10^{2}	1,4·10^{5}	2,8·10^{2}	9,1·10^{4}	4,0·10^{2}	2,2·10^{2}
4,5	4,3·10^{2}	1,2·10^{5}	2,5·10^{2}	8,1·10^{4}	3,6·10^{2}	2,0·10^{2}
5	3,8·10^{2}	1,1·10^{5}	2,3·10^{2}	7,3·10^{4}	3,2·10^{2}	1,8·10^{2}
6	3,2·10^{2}	9,7·10^{4}	1,9·10^{2}	6,1·10^{4}	2,7·10^{2}	1,5·10^{2}
7	2,7·10^{2}	8,3·10^{4}	1,6·10^{2}	5,2·10^{4}	2,3·10^{2}	1,2·10^{2}
8	2,4·10^{2}	7,2·10^{4}	1,4·10^{2}	4,5·10^{4}	2,0·10^{2}	1,1·10^{2}
9	2,1·10^{2}	6,4·10^{4}	1,2·10^{2}	4,0·10^{4}	1,8·10^{2}	1,0·10^{2}
10	1,9·10^{2}	5,8·10^{4}	1,1·10^{2}	3,6·10^{4}	1,6·10^{2}	90
15	1,2·10^{2}	3,8·10^{4}	77	2,4·10^{4}	1,0·10^{2}	60
20	96	2,9·10^{4}	57	1,8·10^{4}	81	45
25	77	2,3·10^{4}	46	1,4·10^{4}	65	36
30	64	1,9·10^{4}	38	1,2·10^{4}	54	30
35	55	1,6·10^{4}	33	1,0·10^{4}	46	25
40	48	1,4·10^{4}	28	9,1·10^{3}	40	22
45	43	1,2·10^{4}	25	8,1·10^{3}	36	20
50	38	1,1·10^{4}	23	7,3·10^{3}	32	18
60	32	9,7·10^{3}	19	6,1·10^{3}	27	15
70	27	8,3·10^{3}	16	5,2·10^{3}	23	12
80	24	7,2·10^{3}	14	4,5·10^{3}	20	11
90	21	6,4·10^{3}	12	4,0·10^{3}	18	10
100	19	5,8·10^{3}	11	3,6·10^{3}	16	9,0
120	16	4,8·10^{3}	9,6	3,0·10^{3}	13	7,5
140	13	4,1·10^{3}	8,2	2,6·10^{3}	11	6,4
160	12	3,6·10^{3}	7,2	2,2·10^{3}	10	5,6
180	10	3,2·10^{3}	6,4	2,0·10^{3}	9,1	5,0
200	9,6	2,9·10^{3}	5,7	1,8·10^{3}	8,1	4,5
300	6,4	1,9·10^{3}	3,8	1,2·10^{3}	5,4	3,0
400	4,8	1,4·10^{3}	2,8	9,1·10^{2}	4,0	2,2
500	3,8	1,1·10^{3}	2,3	7,3·10^{2}	3,2	1,8
750	2,5	7,7·10^{2}	1,5	4,9·10^{2}	2,1	1,2
1000	1,9	5,8·10^{2}	1,1	3,6·10^{2}	1,6	0,90
1200	1,6	4,8·10^{2}	0.96	3,0·10^{2}	1,3	0,75
1500	1,2	3,8·10^{2}	0,77	2,4·10^{2}	1,0	0,60
1700	1,1	3,4·10^{2}	0,68	2,1·10^{2}	0,96	0,53

Design rates of surface contamination, caused by α- and β- radiation radionuclides, and radiation protection systems (such as ventilation, dust suppression, decontamination, shielding) under design, must assure no exceeding of $\mathbf{PC^{P}_{\alpha 2}}$, $\mathbf{PC^{P}_{\beta 2}}$ and $\mathbf{PDR^{P}_{2}}$ numerical values (presented in Table 2.6-2) in implementing the work at WP of group 2.

Design acceptable levels for WP of group 3

ADL of dose rate of external radiation ($\mathbf{PDR^{P}_{3}}$) and concentration of radioactive aerosols for α- and β-radiation radionuclides (accordingly, $\mathbf{PC^{P}_{\alpha 3}}$ and $\mathbf{PC^{P}_{\beta 3}}$) are established.

The inequality must be true:

$$\frac{\mathbf{C_{\alpha 3}}}{\mathbf{PC^{P}_{\alpha 3}}} + \frac{\mathbf{C_{\beta 3}}}{\mathbf{PC^{P}_{\beta 3}}} + \frac{\dot{\mathbf{E}}_{\mathbf{ext,3}}}{\mathbf{PDR^{P}_{3}}} \leq \mathbf{1} \qquad (2.6.3)$$

Where:

- **$C_{\alpha 3}$ ($C_{\beta 3}$)** – calculation design values of concentrations of α− (β−) radiation radionuclides in the air of WP of group 3;
- $\dot{\mathbf{E}}_{\mathbf{ext,3}}$ – calculation design value of dose rate of external radiation at PM of group 3.

Values of contamination $\mathbf{PC^{P}_{\alpha 3}}$, $\mathbf{PC^{P}_{\beta 3}}$ and $\mathbf{PDR^{P}_{3}}$ are indicated in table 2.6-3.

Table 2.6-3. Values of $\mathbf{PC^{P}_{\alpha 3}}$, $\mathbf{PC^{P}_{\beta 3}}$ and $\mathbf{PDR^{P}_{3}}$ WP of group 3.

$\mathbf{PC^{P}_{\alpha 3}}$, **Bq·m^{-3}**	$\mathbf{PC^{P}_{\beta 3}}$, **Bq·m^{-3}**	$\mathbf{PDR^{P}_{3}}$, **mR·h^{-1}**
0.12	34	0.96

For WP of group 3 in addition to ADL established in item 3.3.2.1 it is established ADL of contamination of premises surfaces and equipment located in them by α- and β-radiation radionuclides (accordingly, $\mathrm{ACnt^{P}_{\alpha 3}}$ and $\mathrm{ACnt^{P}_{\beta 3}}$).

The set of inequalities must be true:

$$\begin{cases} \dfrac{\mathrm{Cnt}_{\alpha,3}}{\mathrm{ACnt^{P}_{\alpha,3}}} \leq 1 \\ \dfrac{\mathrm{Cnt}_{\beta,3}}{\mathrm{ACnt^{P}_{\beta,3}}} \leq 1 \end{cases} \qquad (2.6.4)$$

Where, **$Cnt_{\alpha 3}$**, **$Cnt_{\beta 3}$** – calculation design contamination of surfaces by α- (β-) radiation radionuclides.

Values of $\mathrm{ACnt^{P}_{\alpha 3}}$ and $\mathrm{ACnt^{P}_{\beta 3}}$ are indicated in table 2.6-4.

Table 2.6-4. Values of $ACnt^{P}_{\alpha 3}$ and $ACnt^{P}_{\beta 3}$ for WP of group 3.

$ACnt^{P}_{\alpha 3}$, particle·min^{-1}·sm^{-2}	$ACnt^{P}_{\beta 3}$, particle·min^{-1}·sm^{-2}
5	2000

2.6.1.1.2 Technical Measures

The radiological protection hardware will include:

- Organization of access routes,
- Shielding,
- Dust suppression,
- Decontamination,
- Ventilation,
- Use of remotely controlled equipment.

The feasibility and applicability degree of any technical activity will be defined on the basis of ALARA principle, on condition that the non-exceeding principle is implicitly observed and the industrial safety requirements are met, including, non-exceeding of ADL. The ALARA analysis will be also carried out for construction.

Organization of Access Routes

Requirements to organization of access routes are specified in item 2.4.5.

Shielding

No special requirements for external localizing structures regarding ionizing exposure shielding are imposed. However, a possibility for local shielding of rooms where personnel stay permanently or periodically will be designed and also workplaces periodically or constantly attended. For certain rooms and workplaces, in future, additional temporary shielding may be required (for the period of temporary worsening of radiological conditions in the process of FCM retrieval).

The maintenance and repair of NSC systems will be organized to ensure minimal possible doses for the personnel in places with high radiation fields.

It will be foreseen to provide subsequent local shielding with zones for management of FCM and other HLW.

Dust Suppression

The Design, as required, will justify the dust suppression systems in the zones for RAW retrieval and fragmentation, where intense lifting of radioactive dust is possible. Its functions shall include minimization of dust lifting and carry over from the surfaces of OS structures.

Decontamination

In NSC CS-1 the system of decontamination and the personnel sanitary processing will be designed according to the requirements stated in section 2.11.5.

Ventilation

An effective ventilation system, meeting the criteria and requirements stated in section 2.11.3.2, will be designed in NSC CS-1.

Use of Remotely Controlled Equipment

Remotely controlled equipment for dismantling of unstable structures will be designed according to the requirements stated in this CDSD chapter.

The feasibility and application extent of remotely controlled machinery during management of other RAW will be defined on the basis of the ALARA principle.

2.6.1.1.3 Individual Protection Means

Based on the expected radiological conditions and nature of the work to be performed, the individual protection means (protective overalls, masks for protection of respiratory tract, eyes) will be defined for NSC CS-1 normal operation.

RIPM depending on the WP group are applied as follows:

- WP group 1 - respirators or isolating RIPM are applied;
- WP group 2 - respirators are applied;
- WP group 3 - respirators are not applied.

Thus, design radiation conditions on workplaces of the stated groups should not exceed ADL specified in item 2.6.1.1.

2.6.1.1.4 Radiological Monitoring

An effective radiological monitoring system (RMS) for NSC CS-1 in compliance with criteria and requirements will be designed in NSC CS-1, stated in section. 2.11.1.3..

2.6.1.2 Requirements for Assurance of Public and Environment Protection under NSC Normal Operation

The public and environment protection will be provided, meeting the [1.2.1] requirements.

NOVARKA will provide and substantiate in design documentation the non-exceeding of the acceptable design levels of radioactive releases from NSC, given further from [1.2.6], including OS, via ventilation system, and from leakages of external NSC limiting structures, including the dismantling activities. .

At ADL definition in [1.2.6] the assurance factor – 2 is used, that is regulated by [1.2.3] for designing of radiation protection. During evaluation of protective measurements, the calculated design releases and discharges with ADL will be compared. As [1.2.6] already uses assurance factor – 2, at calculations of design parameters of radiation parameters the factor will not be used.

Release limits are established on effective height more than 110m (RLH) and less than 110m. (RLL).

The following set of inequalities must be true:

$$\begin{cases} \dfrac{R_H}{RL_H} \le 1 \\ \dfrac{R_L}{RL_L} \le 1 \end{cases} \qquad (2.6.5)$$

Where, R_H and R_L calculation design values of releases, accordingly, on the height more than 110 m and less than 110 m. Average magnitudes of releases are calculated during a month.

Values of RL_H and RL_L are indicated in a table 2.6-5 [1.2.6]. One of the options indicated in this table will be chosen.

Table 2.6-5. Values of NSC release limits.

Option	1	2	3	4	5	6
RL_H, MBq·month^{-1}	4900	4500	4000	3500	3000	2500
RL_L, MBq·month^{-1}	0	190	450	700	800	810

Separate Technical resolution on setting quotes on limits of “low” release from NSC [1.12.4] recommends NOVARKA to consider “low” release through the leaks of existing OS structures, which belong to NSC protective facility according to NSC FS (CD) during developing calculation of releases. Release is evaluated by value of 14 MBq/month.

For total limit against all sources of “low” release, NOVARKA will take values, indicated in table 2.6-5 for limit of “low” release, reduced by values of evaluated release through OS building structures, which are limiting ones for NSC - 14 MBq/month. This evaluation will be used for the case, when the most part of Turbine Hall structures is covered by NSC facility.

NOVARKA will take into account in his calculations, a release from the Deaerator Rack ventilation systems, as “low” or as “high”, depending on the taken design solutions on arrangement of removing the release from the existing arrangement location of drawdown pipes outside or within the borders of NSC protective facility.

NOVARKA will provide design resolutions, under which release from NSC to Unit 3 will be small compared with the limit of complete “high” release from NSC.

In calculations, isolation during NSC ventilation operation between OS and ventilation stack of Unit 3 will be taken into account.

Non-exceeding of permissible radioactive release values will be provided by the systems of dust suppression, filtration and gas purification, as well as by means of releases and environment monitoring.

NOVARKA will provide with non-exceeding of radioactive substances releases extreme levels outside the borders of NSC industrial site, taking into account the NSC CS-2 activity.

DL are established for ^{90}Sr ($DL_{Sr\text{-}90}$), for ^{137}Cs ($DL_{Cs\text{-}137}$) and for α–radiation radionuclides ($DL\alpha$).

The following set of inequalities must be true:

$$\begin{cases} \dfrac{D_{Sr-90}}{DL_{Sr-90}} \le 1 \\ \dfrac{D_{Cs-137}}{DL_{Cs-137}} \le 1 \\ \dfrac{D_{\alpha}}{DL_{\alpha}} \le 1 \end{cases}, \qquad (2.6.6)$$

Where $D_{Sr\text{-}90}$, $D_{Cs\text{-}137}$ and D_{α} calculation design values of discharges, accordingly, ^{90}Sr, ^{137}Cs and α–radiation radionuclides. Average magnitudes of discharges are calculated during a month.

Values of DL_{Sr-90}, DL_{Cs-137} and DL_{α} are indicated in table 2.6-6 [1.2.6].

Table 2.6-6. Values of NSC discharge limits.

DL_{Sr-90}, MBq·month^{-1}	320
DL_{Cs-137}, MBq·month^{-1}	650
DL_{α}, MBq·month^{-1}	13

Non-exceeding of permissible radioactive release values will be provided with:

- Exclude penetration of precipitation inside the NSC;
- Limit air moisture condensation by means of ventilation and local heating (the need for any local condensation collection systems will be determined during Design in conjunction with completing the NSC CS-1 ventilation design);
- Minimize generation of industrial liquid RAW when performing the different technological functions of the NSC;
- Exclude possibility for unorganized discharge of liquid radwaste;
- Establish system for liquid radwaste collection, accumulation, and hand over for processing;
- Ensure reliability of the existing system and establish (as required) additional protection to minimize the liquid media discharge to the hydrogeological environment.

To prevent the spread of radioactive substances into the environment through contaminated equipment or transportation, the decontamination facility shall be provided for radiological monitoring and decontamination of equipment and transportation leaving “dirty” zone boundaries. This Sanitary Treatment Point has to be created prior to start of works at the site.

To exclude the impact on the public and the environment as a result of some unauthorized use of radioactive materials, certain measures for the monitoring of nuclear and radioactive materials will be foreseen.

2.6.1.3 Requirements and criteria of potential exposure mitigation

During NSC CS-1 design, Design sections related to the assurance of radiological safety will include the design calculations for probability of critical events, and respective doses of potential exposure, with justification and description of procedures for radiation safety assurance. In addition to that, it is necessary to provide justification for activities reducing those probabilities and doses down to regulated values and further reasonably achievable levels.

Design criteria of potential radiation limitation for NSC are established in [1.2.7]. These design criteria are set according to the requirements of section 2.7 of [1.2.2].

Levels of potential irradiation due to first group sources (irradiation of a limited number of people) must correspond with [1.2.2].

[1.2.2] Tables 2.1 and 2.2 provide values of reference probabilities for critical events related to the sources of potential exposure sources.

Design criteria on restriction of potential exposure to group II sources are provided in [1.2.7].

During NSC CS-1 design, all the sources of potential exposure are seen as sources of first or second groups depending on the scales of consequence of realization of the critical events (CE) at NSC.

Sources of first group potential exposure should include ones connected with CE of NSC accompanied by exposure of individual or limited groups of persons in NSC and in borders of 10 km sanitary - protective zone.

Sources of second group potential exposure should include those connected with CE of NSC that results in municipal radiation accident of local, regional or global scale (NRBU-97) with radiation impact on the public that can live out of 10 km NSC sanitary - protective zone during design term of NSC operation

Design criteria for limitation of the potential exposure (LPE) from NSC

For LPE of the personnel from the sources of the first group, meeting the requirements of it, (2.7 of [1.2.2]) Design Criteria are established as probabilities of CE ($P_{0,1}$) and appropriate doses of potential exposure to the personnel ($D_{0,1}$)(Table 2.6-7).

Table 2.6-7. Design Criteria regarding probabilities of CE ($P_{0,1}$) that are accompanied with the realization of the potential exposure of the personnel from the sources of the first group, depending on the doses of potential exposure ($D_{0,1}$)

Dose of potential exposure to the personnel, $D_{0,1}$			**Probability of CE, $P_{0,1}$, event/year**
Dose types	**Units**	**Interval**	
Effective	mSv per event	Does not exceed 100	$1 \cdot 10^{-2}$
		More than 100	$2 \cdot 10^{-4}$
Equivalent		150-500	$2 \cdot 10^{-4}$
Absorbed	mGy per event	More than 1000	$5 \cdot 10^{-7}$

For LPE of the public from the sources of the second group the design criteria are established as probabilities of CE ($P_{0,2}$) and appropriate (due to CE realization) densities of the radioactive contamination of the territory with “typical mixture” of long-lived r-radionuclides ($\sigma_{0,r}$), present in the Object Shelter (Table 2.6-8). $\sigma_{0,r}$ criterion is introduced as a more convenient for practical use value, derived from the dose of the potential exposure to the public from the sources of the second group ($D_{0,2}$), which is realized in the result of the CE by contamination of the territory. The rates of area contamination can be connected with the tolerance probabilities of such CE through analyses of potential exposure, calculated from the base of design scenarios of CE. It is not possible to do this now but CDSD provides the criteria set in the normative document [1.2.7].

The design criteria presented subject to relative radionuclide composition of the “typical mixture” (Table 2.6-9) for its components ^{137}Cs and $^{239+240}$Pu. These radionuclides are more convenient for monitoring purposes in case of CE and widespread territory contamination.

Presented in Table 2.6-9 the reference ratios of contributions of radionuclides (A*r*) activity into the total activity of the typical for the Object Shelter mixture are correspond with the conservative options, which is expected in 100 years (design operational term for NSC). The last column of this table presents the relative contributions of activity of individual transuranic elements (Aα,*r*) to the total alpha-activity

Table 2.6-8. Design criteria regarding probabilities of the CE ($P_{0,2}$), which are accompanied with the realization of the potential exposure to the public from the sources of the second group, depending on the densities of the territory contamination with “typical mixture” of long-lived radionuclides, which exist in the Shelter ($\sigma_{0,r}$)

$\sigma_{0,r}$, kBq/m^2	**$P_{0,2}$,**

		event/year
Radionuclide of the "typical mixture"		
^{137}Cs	**$^{239+240}$Pu**	
< 0,7	< 0,06	$1 \cdot 10^{-2}$
0,7 – 7	0,06 – 0,5	$2 \cdot 10^{-4}$
7 – 50	0,5 - 4	$2 \cdot 10^{-5}$

Table 2.6-9. The reference ratios of contributions of radionuclides (A_r) activity into the total activity of the typical for the Object Shelter mixture and contributions of individual activities of alpha-emitters ($A_{\alpha,r}$) to the total alpha activity of transuranic elements

Radionuclides of the typical mixture	A_r	$A_{\alpha,r}$
^{90}Sr	0,27	-
^{137}Cs	0,59	-
^{238}Pu	0,01	0,07
$^{239+240}$Pu	0,05	0,35
^{241}Pu	0,01	-
^{241}Am	0,08	0,58

While establishing the design criteria of Table 2.6-8 it was accepted that in case of communal accident the doses of the potential exposure will not exceed the lowest threshold of occurrence of deterministic effects and levels of intervention justification (Table P.8.1.[1.2.1]). Thus, the design criteria, presented in Table 2.6-8 regarding probabilities of the CE, guarantee the protection from accidental effect at the level applicable for an individual and society at large.

If the calculations demonstrate that the realization of the CE may lead to contaminations of the territory higher than shown in Table 2.7-8, then this should be considered as a possibility of occurrence of deterministic effects or necessity of mass resettlement. The design criteria of probability of such CE is established at the level $P_{0,2} = 1 \cdot 10^{-7}$ year^{-1}.

Such a low probability of the CE in the design scenarios may be achieved on the account of the fact that it is a result of a series of probabilities of independent interim events.

Regarding the sources of potential exposure during the design any activities on construction, commissioning and operation of NSC CS-1, the following is to be justified and limited:

- Calculated design probabilities of CE occurrence (P_1 and/or P_2) correspondingly, for the first and/or second group potential exposure sources;
- Calculated design values of the dose of potential exposure (D_1), that accompanies the realization of the designed CE (for the first group PE sources);
- Calculated design value of density of contamination with the long-lived radionuclides (σ_r) of the territory beyond the boundaries of sanitary protective zone (for the sources of potential exposure of the second group).

The procedures of getting these calculated values shall be performed and reflected in the design meeting the requirements of Section 3 [1.2.2].

The comparison of calculated design values P_1, P_2, D_1 and σ_r with correspondent design criteria presented in Tables 2.6-7 and 2.6-8 should be performed. The calculated design probability of the CE shall not exceed the following:

- $P_{0,1}$, when CE, being regarded, is accompanied with the realization of the potential exposure to the personnel at NSC, its site and within the boundaries of its sanitary protective zone

(the CE sources of the first group) and the calculated design value of the dose D_1 is within the appropriate dose interval $D_{0,1}$;

- $P_{0,2}$, when CE, being regarded, is accompanied with the realization of the potential exposure to the public beyond the boundaries of NSC sanitary protective zone (the CE sources of the second group) and the calculated design values of the density of the contamination σ_r for components of radionuclides mixture ^{137}Cs and $^{239+240}Pu$ are within the appropriate interval $\sigma_{r\ 0,\ r}$.

In order to evaluate consequences, related to complete or partial NSC destruction, NOVARKA will use the data on radioactive dust release, presented in Technical resolution on establishing the input data on dust release into atmosphere during accidents with destructions of NSC protective structure [1.12.21].

Input data are established on the basis of the previously performed analyses of potential accidents with collapse of OS building structures, with NSC destruction under influence of F 3.0 class tornado.

The following main dust accumulations are considered. The accumulations are located in:

- OS sub-roof space, which will be in direct contact with the air space of NSC main volume after roof disassembly;
- In reactor shaft and OS rooms, which freely adjoin with OS sub-roof space;

Amount of fuel dust in the main accumulations is evaluated:

- Sub-roof space – 1100 kg;
- Reactor shaft and rooms, adjoining with sub-roof space – 400 kg.

Relation of total dust amount (including non-radioactive component) to the fuel dust is evaluated as 100 : 1.

Specific activity concentration of fuel dust (for 2005) is evaluated as $A = 2{,}3 \cdot 10^{12}$ Bq/kg.

Conservative evaluations of fuel dust release into the atmosphere, depending on scenario, are provided in table 2.6-10.

Table 2.6-10. Release of fuel dust depending on ejection scenario

Scenario of dust release into atmosphere from NSC	Fuel dust release	
	Amount	Activity, Bq (for 2005)
Involvement of dust directly into tornado whirlpool of F 3.0 class due to considerable destruction of NSC covering (or NSC completely)	500 kg	$1,2 \cdot 10^{15}$
Dust lifting into atmosphere due to NSC structures collapse on dust accumulations in the central hall	8 kg	$1,9 \cdot 10^{13}$
Involvement and release into atmosphere of dust by air flows, occurring inside NSC (for example, as a result of sharp pressure change in NSC, under limited damages of the covering by tornado)	К · V[1)]	А · К · V

1) Where:

К – activity concentration of fuel dust in the air – 0,001 g/m^3 when damage area is less than 5% of total NSC covering area, and 0,01 g/m^3 when damage area is more than 5%;

V – air flow through NSC covering damages.

Scenarios of flying devices falling at NSC and explosion inside NSC are not considered, since in compliance with i. 3.2.2 and 3.3.2 [1.12.8] negligibly low probabilities of such events should be provided.

For the same reason, combinations of impacts on dust accumulations, presented in table, with other impacts (for example, the occurrence of a combination of structures collapse on dust accumulations in central hall and fire) are not considered.

The design will consider all possible initiating events, including failure of the facility, system and element, as well as external events leading to those failures, and personnel errors.

For each initiating event selected based on the preliminary analysis results, possible scenarios of accident evolution will be developed, and scenarios leading to the most hazardous consequences will be indicated. It is necessary to evaluate the probability of certain scenarios for accident evolution.

For each scenario of accident evolution calculations of accident possible consequences for the personnel and the environment, including personnel at adjacent ChNPP facilities and in the exclusion zone, will be performed. Calculations of the expected release of radioactive substances and/or ionizing exposure beyond the NSC boundaries, including releases and discharges to the environment will be performed.

Based on the results of the above analysis, complex of organizational and technical activities to prevent the potential accidents and/or mitigate their consequences will be defined.

2.6.1.4 Specifics of Radiological Safety Assurance during NSC Construction

The following main specific features shall be considered during NSC CS-1 objects construction:

- Work implementation under radiological conditions;
- Availability of radioactively contaminated man-caused layer.

NSC CS-1 will be constructed considering the ALARA principle and with generation of the minimum possible amount of secondary radwaste.

NOVARKA will propose and substantiate methods of well-boring under foundation piling at the design stage, taking into account protection against the radioactive contamination of ground waters.

During construction of the NSC CS - 1 objects, the complex of measures will be stipulated for the personnel radiation protection under normal work conditions, on mitigation of potential exposure, prevention and mitigation of the consequences of radiation accidents.

The Table 2.6-11 presents the main factors impacting personnel, public and environment, as well as the most important technical measures during NSC SC-1 construction.

Table 2.6-11. Main impact factors and the most important technical measures during SC-1 NSC construction

Potential Impact Requirements for Safety Assurance	**The Most Important Technical Measures**
Increase in concentration of airborne radionuclides in the working zone. Personnel exposure. Possible release of radioactive substances into the environment during excavation and other works.	– During development of the design for the NSC CS-1 construction the preference shall be given to such decisions which will have a minimum impact on man-caused layer; – Use of excavation techniques causing minimum dust release; – Application of dust suppression activities, local ventilation, decontamination; – Use of lightweight localizing structures over the work zones (to prevent the radioactive dust spread); – Establishment of control levels and careful monitoring of radiation conditions over working zones and environment, in particular, exposure doze rate, surface contamination, volumetric activity of aerosols in air; – Use of IPM and RIPM relevant to work conditions, providing prevention of contamination and the personnel internal exposure according to requirements of radiation safety.
Radioactive contamination groundwater	– Use of foundation technology taking into account minimization of contamination distribution from technogenic layer, including prevention from ground water contamination; – Use of lightweight localizing structures over the work zones (to prevent precipitation penetration into foundation pits); – Organisation of LRAW management (collection, accumulation, and transfer for processing); – Monitoring of groundwater, and definition of radionuclide composition of groundwater samples from the monitoring wells.
Personnel exposure during construction and erection operations	– Minimisation of performance of works close to OS. Use of remotely controlled technologies. Use of preassembly technologies under more favourable radiation conditions; – Provision for more effective use of shielding at the work places in the radiological hazardous zones, when indicated by ALARA calculations; – NSC CS-1 construction shall be performed without compromising the existing OS envelope. The NSC Cs-1 shall

Potential Impact Requirements for Safety Assurance	The Most Important Technical Measures
	be designed to minimize the probability of OS structural collapse to the maximum possible extent; – Establishment of control levels and careful radiation monitoring over work zones and management of RAW and contaminated technological materials, in particular, during soils removal; – Performing of individual dosimeter biophysical control of internal exposure doses of the personnel, performing of measurement of radionuclides intake for calculation of internal exposure individual doses, registering of personnel exposure doses and performing planning of radiological loads on the personnel, establishment of control levels, use of necessary IPM and RIPM; – Training of the personnel, including the general preparation and also special preparation for specific kinds of works in established zones.
Contamination distribution over works performance areas	– Zoning with corresponding control levels and establishment of barriers on borders of zones; – Organization of access control, in particular, radiation monitoring of contamination; – Decontamination of contaminated vehicles, mechanisms, equipment; – Maintenance with sanitary – domestic rooms, sanitary locks and so on.

2.6.2 NUCLEAR SAFETY CRITERIA

To ensure NSC nuclear safety all activities on NSC construction and operation will be performed in accordance with [2.1.3, 2.1.4, 2.1.5].

Assurance of nuclear safety means establishment and maintenance of conditions provided to prevent an origination of self-sustaining chain reaction, and limit its consequences.

Furthermore, the effective factor for multiplication of isolated system neutrons shall not exceed 0.95 under normal and design incident conditions.

To meet the main requirements of nuclear safety during NSC design the following shall be provided:

- Exclude the possibility for ingress of hazardous amount of hydrogenous substances to the FCM accumulations, and to the equipment for their management (exclude ingress of precipitation; limit condensation of ambient air moisture; practically exclude the risk of FCM accumulation flooding as a result of technological system accident);
- During FCM management the designed hardware shall provide conditions to avoid ingress of FCM, and active zone fragments in particular, in hazardous amounts to the "hazardous performance" type equipment and utilities;
- Prevent collapse of structures during dismantling of structures and equipment, as well as during removal of FCM and other radwaste, since such collapse could lead to an uncontrolled movement of the most hazardous FCM accumulations.

The NSC shall be provided with the following systems to prevent a nuclear incident and mitigate its consequences:

- Nuclear Safety Monitoring System (NSMS);
- FCM Monitoring System.

The systems shall be arranged in such a way that any design-basis accidents do not have any negative impact on their normal functioning.

The Design of NSC shall include organizational and technical measures to reduce the consequences of self-sustaining chain reaction origination developed by others.

The NSC design shall consider the registration, monitoring and physical protection of nuclear materials to prevent their unauthorized spread. The NSC design shall consider accommodation of the system for monitoring of nuclear materials haul.

Following FCM accumulations are taken into account:

- FCM accumulations in TH:
  - In the area of the reactor shaft in coordinates rows Л-Н, axes 45-46;
  - Under the blockage in coordinates rows И-Л, axes 42-44;
  - In the area of suspension unit of fresh fuel in coordinates rows Л-М, axes 40-42;
- FCM accumulations in Reactor Space on escaped destruction part of the reactor support (scheme of RS) in coordinates: rows К-Л, axes 47-48 and rows Л-М, axes 46-48;
- FCM accumulations in room 305/2:
  - Southeast quadrant in coordinates rows И-Л, axes 45-47;
  - Southwest quadrant in coordinates rows И-Л, axes 47-49_{-2000};
  - Along southern wall of room 305/2 in coordinates rows И-$К_{-1000}$; axes 45_{+2000}-49_{-2000}, room 305/2 connected with RP through the destroyed part of scheme of RS in coordinates rows К-Л, axes 46-47;
- FCM accumulation in Southern spent fuel pool in coordinates rows $И_{+2000}$-$И_{+4000}$, axes 44_{+2000}-45.

Note: Structure and geometrical features of NSC equipment where FCM can accumulate, shall not make possible the occurrence of SSCR under any expected conditions.

During NSC CS-1 construction, conditions will be created to keep the unbroken efficiency of all FCM monitoring systems “Finish-P”, “Signal” and/or monitoring systems of nuclear safety IAMS, as well as FCM Criticality Control System (delivery of gadolinium nitrate solution system, neutron absorbing solution delivery system, the modernized dust suppression system) or compensating measures to achieve the acceptable safety level will be specified.

During construction (especially during implementation of preparatory works) it is necessary to provide the registration, monitoring and physical protection of retrieved nuclear materials to avoid their unauthorized spread.

2.6.3 CLASSIFICATION SCHEME FOR NSC SYSTEMS, STRUCTURES & COMPONENTS (SSC)

The approach to safety classification is developed based on the following considerations:

- OS and respectively NSC are not nuclear facilities and consequently are not covered by requirements that are established in normative documents applicable for nuclear industry facilities;
- Based on the above, the requirements of NP [НП] 306.2.0141-2008 (OPBU), including those related to classification of systems and equipment, are not imposed on the OS or the NSC;
- There are no safety systems in this facility, the necessities for which are determined by special standards applicable for nuclear facilities.
- NSC CS-1 objects SSC includes two groups:
    - SSC important to safety (SSC IS) specifically SSC IS-1, SSC IS-2;
    - SSC no impact on safety (SSC NIS).

(The term "safety" implies radiation and nuclear safety.)

2.6.3.1 NSC SSC Classification Principles

Pursuant to section 7.3 of the NSC Design Criteria and Requirements, safety classification group and category of SSC (SSC IS-1, SSC IS-2 or SSC NIS) are determined taking into consideration the following:

- Functions performed by SSC;
- Consequences of SSC failures.

SSC related to safety, are designed to perform the following functions:

- Limit the output of radioactive substances and ionizing radiation to meet existing criteria;
- Provide protective radiation retention barriers;
- Control functions of radiological protection;
- Radiation monitoring;
- Nuclear safety monitoring.

SSC IS includes SSC, the failure of which entail or may entail violating radiation or nuclear safety criteria. Radiation and nuclear safety criteria are determined by acceptability of risks for the personnel, the public and the environment.

Taking into account:

- Levels of SSC failure consequences;
- Estimated probability of such consequences.

The classification scheme has two categories of SSC IS which shall be considered:

- Category 1 - systems, structures and components, failure of which may result in:
    - Occurrence of critical event (CE), whose probability shouldn't exceed [1.2.7]:
        - $2{\cdot}10^{-4}$ /year, if effective dose of potential radiation for an individual or limited group of people of the personnel is more than 100 mSv;
        - $2x10^{-4}$/year, if equivalent potential exposure dose for an individual or limited group of personnel is 150-500 mSv;
        - $5{\cdot}10^{-7}$ /year, if absorbed dose for an individual or limited group of people of the personnel is more than 1000 mGy;

  - $2{\cdot}10^{-4}$ /year, if residual additional surface contamination density of the territory outside the 10 km area around NSC is 0,7 to 7 kBq/m^2 for ^{137}Cs and/or 0,06 to 0,5 kBq/m^2 for $^{239+240}$Pu
  - $2{\cdot}10^{-5}$ /year, if residual additional surface contamination density of the territory outside the 10 km area around NSC is 7 to 50 kBq/m^2 for ^{137}Cs and/or 0,5 to 4 kBq/m^2 for $^{239+240}$Pu
  - $1{\cdot}10^{-7}$ /year, if residual additional surface contamination density of the territory outside the 10 km area around NSC is more than 50 kBq/m^2 for ^{137}Cs and/or more than 4 kBq/m^2 for $^{239+240}$Pu.
 - Violation of nuclear safety criteria, taking into account radiological consequences for the personnel.

- SSC not defined as SSC IS-1, the failure of which may lead to exceeding of established limits for safe operation, namely, the design-based parameters of technological processes, deviation from which can result in an accident.

  In accordance with document “Design Criteria for Limitation of Potential Exposure for New Safe Confinement” the probability of Critical Event resulting in a SSC IS-2 failure shall not exceed 10^{-2} / year.

The classification labelling is:

- SSC IS-1 - Normal operating system important to safety, 1st category;
- SSC IS-2 **-** Normal operating system important to safety, 2nd category;
- SSC NIS **-** Normal operating system not important to safety.

NOVARKA should develop and substantiate in the design SSC classification on the basis of detailed resolutions developments on SSC, analysis of their functioning, safety analysis performance with evaluation of SSC influence on NSC safety.

In order to specify SSC classification NOVARKA should consider the consequences of critical events’ (CE) typical scenarios in the design, and don’t restrict themselves with them if possible:

- Release of radioactive substances in the air outside the established limits in the amounts, exceeding the admissible values;
- Release of ionizing radiation (from the known sources) beyond the established limits in the amounts, exceeding the admissible values;
- Sudden release of ionizing radiation (from the known sources) beyond the established boundaries in the amount, exceeding the admissible values;
- Flooding of liquid radioactive substances;
- Contamination with radioactive substances of surfaces (for example equipment, territory) more than the established values;
- Contamination with radioactive substances of the main individual protection means above the established levels;
- Failure of basic PPE;
- Unauthorized presence of a man in radioactive-dangerous zone;
- Unauthorized displacement of ionizing radiation source by a man.

In general case central intermediary events lead to CE (CIE – event, whose realization makes direct threat of CE implementation [1.2.5]) of the following main types:

- Intense dust generation or dust lifting during works performance;
- Failure, removal, destruction of protective barriers (protective shielding, protective structures, containers, packages);
- Destruction of structures, not planned by works performance plan;
- Falling (of load, cranes, structures, other objects);
- Strike (by flying objects, liquid stream);
- Internal fire, explosion;
- Internal flooding;
- Self-sustaining chain fissile reaction;
- Sharp changes of internal environment parameters – temperature, pressure, humidity, chemical activity(i.e., changes, whose speed exceeds the limits established for technological processes);
- Violation of monitoring, alarm and warning;
- Violation of ventilation conditions;
- Failure of power supply systems or working environment;
- Failure of additional PPE;
- Personnel error or other actions of persons (of the personal or strangers), which directly lead to CE.

In its turn, CIE may be caused by definite initial events, namely:

- Failure of operated SSC or failures of hardware, used during works performance;
- External events, which lead to failures of the above mentioned SSC or hardware;
- Failure of operational procedures;
- Errors of personnel, performing the works.

2.6.3.2 Requirements for Design of the SSC IS

SSC IS shall be designed considering the following:

- General industrial norms, rules and standards related to these SSC;
- Separate specific requirements established for NSC;
- Additional requirements based on normative documents and related to the SSC IS specifics.

Categories 1 and 2 of SSC IS differ in some design requirements. The differences are mainly related to the following:

- External impacts resistance;
- Redundancy;
- Reliability, including power supply;
- Necessity to apply specific normative documents (for example; for design, RAW, nuclear materials management, fire protection, etc.).

Requirements for SSC IS are in addition to the general industrial norms, rules and standards related to these SSC.

During design of SSC located in unfavourable radiation conditions or in inaccessible places for maintenance, some special reliability and/or redundancy requirements shall be considered independent of their classification.

2.6.3.3 Basic requirements concerning external impact resistance

The impact values listed in the following sections are provided in section 2.3 of the CDSD.

2.6.3.3.1 Seismic impacts

Seismic impacts should be taken into account in accordance with the requirements of sections 2.3.1.1, 2.4.2 and 2.4.3, as well as of the document "Main Normative Requirements and Design Characteristics of Earthquakes for the Chernobyl NPP Site" agreed by the State Committee of Construction of Ukraine letter # 3/19-19 of July 8, 2005.

SSC should keep structural integrity, durability, and work capacity for the following impacts:

- SSC IS-1 – maximum basis earthquake;
- SSC IS-2 – design basis earthquake;
- SSC NIS – general normative earthquake requirements related to construction.

2.6.3.3.2 Wind and airflow impacts

Impacts of wind should be taken into account on SSC located in open sites in accordance with the requirements of sections 2.3.1.2, 2.4.2 and 2.4.3.

These SSC should keep structural integrity, durability, and work capacity under the following impacts:

- SSC IS-1 – extreme wind load;
- SSC IS-2 – limited calculated wind load;
- SSC NIS – characteristic value of wind pressure.

Impact of airflows upon the SSC located inside the NSC or its auxiliary structures should be taken into account. These SSC should keep structural integrity, durability, and work capacity upon impact of the highest airflows corresponding to the limits and conditions of NSC normal operation where the SSC are located.

Impacts of airflows in excess of normal operation of the NSC should be taken into account for SSC IS-1 and SSC IS-2, in order to limit the consequences of SSC failures.

2.6.3.3.3 Snow impacts

Snow impact on SSC located in open sites should be taken into account in accordance with the requirements of sections 2.3.1.3, 2.4.2 and 2.4.3.

These SSC should keep structural integrity, durability, and work capacity upon impacts of:

- SSC IS-1 – extreme snow load;
- SSC IS-2 – limited calculated lsnow load;
- SSC NIS – characteristic value of snow weight.

Dynamic impacts during snow and ice falls from the arch roof shall be considered for the arch and for the SSC around the Arch.

2.6.3.3.4 Tornado impact

Tornado impact on SSC IS-1 categories SSC should be taken into account in accordance with the requirements of sections 2.3.1.4, 2.4.2 and 2.4.3.

These SSC should keep structural integrity, durability, and work capacity upon impacts of a class F1.5 tornado and partially (as it is stated in section 4.3.2.2 of this CDSD) upon impact of a class F3.0 tornado.

2.6.3.3.5 Temperature impact

Temperature impacts on SSC located in open sites should be taken into account in accordance with the requirements of sections 2.3.1.5, 2.4.2 and 2.4.3.

These SSC should keep structural integrity, durability, and work capacity upon impacts of:

- SSC IS-1 – extreme temperature values;
- SSC IS-2 – limited calculated temperature values;
- SSC NIS – ambient air temperature.

Temperature impacts on SSC located inside the NSC or its auxiliary structures should be taken into account on the basis of the temperature and humidity where the SSC are located.

These SSC should keep structural integrity, durability, and work capacity under the most unfavorable temperature impacts of normal NSC operation limits and conditions. Impact of temperatures in excess of normal operations should be taken into account for the SSC IS-1 and SSC IS-2, in order to limit the consequences of SSC failures.

The fire resistance to be considered for the bearing and framework structures of the NSC enclosure is 30 minutes.

The NSC shall be considered as a facility superimposed with the roof, therefore, the fire resistance rates for the NSC structures are as follows:

- For bearing elements: arches, truss framework –a minimum fire resistance limit is R 30 minutes, a maximum fire extension rate is – M0;
- For enclosing structures: decking and girders, - a minimum fire resistance limit is RE 30 minutes (E – preservation of integrity), a maximum fire extension rate is –M0.

The fire safety requirements for SSC are also detailed in «Clarifications of technical requirements regarding systems and auxiliary facilities of NSC ». SIP-P- PM-22- 460-TSN- 102-03. Rev.3 dated 05.07.2006. They are also detailed in sections 2.9.3 and 2.11.2.

2.6.3.3.6 Humidity and precipitations impact

The SSC located in open sites should keep structural integrity, durability, and work capacity at:

3. 100% humidity;
4. Precipitation intensity of:
    - SSC IS-1 – 72 mm per 20 min, 190 mm per day;
    - SSC IS-2 and SSC NIS – 38 mm per 20 min, 105 mm per day.

Humidity impact on SSC located inside the NSC or inside the NSC auxiliary facilities should be taken into account on the basis of temperature and humidity regime in the SSC locations. These SSC should keep structural integrity, durability, and work capacity under the least favorable humidity impacts corresponding to the limits and conditions of the NSC normal operations.

For SSC IS-1 and SSC IS-2, the humidity impact shall also be considered when exceeding the limits and conditions of the NSC normal operations violating established temperature and humidity conditions (100% humidity with condensate generation, or such a way that the criteria on limitation of potential exposure are met).

2.6.3.3.7 Dust impact on systems and components (excluding structures)

Dust impact on systems and components should be taken into account on the basis of dustiness in the systems and components locations.

These systems and components should keep structural integrity, durability, and work capacity under the most unfavorable dust impacts corresponding to the limits and conditions of NSC normal operations.

Per GOST 15150-69 the following values of the mass concentration of dust in the air may be used for systems and components operated in conditions of high dustiness (half-attended and unattended premises):

- For static dust - 5±1 g/m^3, for particles with size on not more than 50 micrometer, at temperature of 55℃, relative humidity of not more than 50% and circulation speed up to 1 m/s;
- For dynamic dust - 10±2 g/m^3 for particles with size of not more than 200 micrometer, at temperature of 55℃, relative humidity of not more than 50% and circulation speed up to 15 m/s.

Impact on SSC of dust conditions exceeding those stated above during normal operations should be taken into account.

For SSC IS-1, SSC IS-2 dust impacts should be considered when normal operation conditions are exceeded so that the criteria identified above on limitation of SSC failures consequences are implemented.

2.6.3.3.8 Vibration impacts

Vibration impacts on SSC (industrial units, automated and computer-based systems of measurement, monitoring, regulation, diagnostics and control) should be taken into account on the basis of possible vibrations in the SSC locations.

These SSC should keep structural integrity, durability, and work capacity under the most unfavorable vibration impacts corresponding to the limits and conditions of NSC normal operations.

Per GOST 17516.1-90, GOST 25804.3-83 and GOST 12997-84 the following parameters: acceleration amplitude of 10 m/s^2 within frequency range of 5-80 Hz, may be used as criteria of vibration impacts for the SSC, which may be exposed to vibration impact during normal operations.

When some characteristics of vibration impact exceed those stated above during normal operations, those high characteristics should be taken into account for impact on SSC.

Vibration impacts due to violations of normal operating conditions connected with increase of vibration over the established operational limits should be taken into account for SSC IS-1, SSC IS-2 in order to follow the criteria of limitation of the SSC failure consequences limitation.

2.6.3.3.9 Mechanical shocks

Mechanical shock impacts on the SSC should be taken into account on the basis of the parameters of possible mechanical shocks in the SSC location places.

These SSC should keep structural integrity, durability, and work capacity at the most unfavorable mechanical shock impacts corresponding to the limits and conditions of the NSC normal operations.

Per GOST 17516.1-90, GOST 25804.3-83 and GOST 12997-84 the following parameters may be used for the SSC, which may be exposed to mechanical shocks during normal operations:

- For single mechanical shock – peak shock acceleration – 50 m/s^2 at duration of 0.5-50 ms;
- For multiple mechanical shock – peak shock acceleration – 100 m/s^2 at duration of 2-50 ms.

When shock acceleration characteristics may exceed the stated ones during normal operations of some SSC, those high characteristics should be specified for impact to the SSC.

In order to limit consequences of failure in accordance with Section 2, the impact of mechanical shock in excess of what is expected during normal operations should be evaluated for SSC IS-1 and SSC IS-2.

2.6.3.3.10 Radiation impacts on systems and components (excluding structures)

Systems and components operated in radiation hazardous conditions should be steady to impact of ionizing radiations.

Radiation impacts on systems and components should be taken into account on the basis of possible parameters of ionizing radiations in the systems and components location places.

These systems and components should keep structural integrity, durability, and work capacity at the most unfavorable impact of ionizing radiation corresponding to the limits and conditions of the NSC normal operations.

Impacts of ionizing radiation that violate the limits and conditions of normal operations connected with exceeding levels of ionizing radiation over the established operational limits should be taken into account for the SSC IS-1, SSC IS-2 in order to follow the criteria of the SSC failure consequences limitation.

2.6.3.4 Requirements to systems and components reliability (excluding structures)

Nomenclature and systems and components reliability parameters are defined on the basis of the rules described in GOST 27.003-90 “Content and general rules of identification the requirements to reliability”.

To estimate the reliability parameters of systems and components the following procedures of basic standards can be used:

DSTU 2860-94 “Terms and definitions”;

- DSTU 2861-94 “Reliability analysis. Basic regulations”;
- DSTU 2862-94 “Calculation methods of reliability indexes. General requirements”;
- GOST 24.701-86 “Unified standardization system of control systems. Reliability of control systems”;
- GOST 27451-87 “Ionizing exposure measurement instrumentation. General technical specifications”;
- GOST 26291-84 “Reliability of nuclear plants and equipment. General regulations and nomenclature of indexes”.
- GOST 25804.2-83 “Instrumentation, devices, gears and equipment responsible for control over technological processes at Nuclear Plants. Reliability requirements”;

- DSTU 2915-44"Conditioning and ventilation equipment. Reliability level requirements at critical failures. Procedure and control methods applied for reliability indexes".

While selecting reliability indexes in the course of design process, one should follow below referenced features subdividing systems and components into different types:

- Determinacy of purpose (production of specific/general destination);
- Quantity of probable states (according to operability) in the course of operation;
- Functioning mode (continuous mode /cycling use);
- Option allowing restoration of operability after failure (restoring/non restoring);
- Option allowing extension of technical life time (reparable /non reparable);
- Option allowing technical maintenance (maintainable/non maintainable).

Systems and components reliability requirements concerning failures must be established with due consideration and analysis of critical failures as indicated in GOST 27.310-95 "Interstate standard. Reliability applied to technique. Analysis of types, consequences and critical failures. General provisions".

Reliability indexes per critical failures must be established in a way not to exceed the radiological criteria.

The following set of single reliability indexes may be established with regards to systems and components:

- Absence of failures – average mean-time-between-failures (hours);
- Longevity – service life (years);
- Reparability – maximum time required for restoration of operability (hours).

Note: composition of single reliability indexes may vary in the course of design process. For instance, the following index is established for absence of failures – probability of failure free work during the established period. Instead of single reliability indexes complex indexes may be applied. In any event, nomenclature and quantity of reliability indexes are established in accordance with the requirements of specific standards (in particular, GOST 27.003-90).

Reparability indexes are established considering complexity and conditions of equipment repair. Reparability indexes for the equipment located within radiation-hazardous areas have to be established based on requirements applied to functioning of equipment with due consideration of optimization of dose rates envisioned for such repair works.

Longevity indexes are established based on designed operation period of SSC (for NSC operation period should not be less than 100 years), with consideration of potential repair or substitution of equipment failed.

In particular, for NSC monitoring and control systems relating to SSC IS-2, one can apply reliability indexes established for Integrated Automated Monitoring System (IAMS):

- Average mean-time-between-failures – 10 000 hours;
- Longevity – service life – not less than 10 years (on condition of repair or substitution of equipment failed);
- Repairability.
    - For fast recoverable – not more than 2 hours;
    - For medium recoverable – not more than 10 hours;

- For long recoverable – not more than 72 hours.

Redundancy requirements are established based on reliability requirements applied to systems and components as well as prevention of potential failures. For SSC IS–1, redundancy of functions important to safety as well as prevention of potential critical failures shall be reviewed as top priority issues. When establishing redundancy level, the consequences of failures, reliability indexes of specific hardware, etc. have to be taken into consideration.

2.6.3.5 Requirements to electromagnetic compatibility on systems and components (excluding structures)

Instrumentation and control systems and components electromagnetic compatibility shall meet GOST 29 073-91 "Compatibility of measurement, monitoring and control over industrial processes hardware. Resistance to electromagnetic noise. General provisions".

I&C systems and components electromagnetic compatibility shall correspond to requirements of the following standards:

- Level of radio noise triggered by electrical equipment and other hardware–GOST 28934-91 and GOST 23450-79;
- Level of NSC monitoring and control systems resistance to impulse noises (spread over power supply and interface networks) –GOST 29254-91 (EN 61000-4-5);
- Level of NSC monitoring and control systems resistance to nanosecond impulse noises–GOST 29156-91 (IEC 801-4);
- Level of NSC monitoring and control systems resistance to external electromagnetic field influence–GOST 29191 - 91(ENV 50 140);
- Level of monitoring and control systems resistance to electrostatic discharges – GOST 29191-91 (IEC 801-2).

Parameters corresponding to level 3 of electromagnetic impact on equipment may be applied to determine systems and components resistance to electromagnetic influences.

In case specific characteristics of electromagnetic influence may exceed the established ones (level 3 of electromagnetic impact on equipment), such advanced characteristics shall be considered when influence on systems and components takes place.

Level of electromagnetic impact on equipment applied for systems and components has to be established with consideration of potential origin of extreme electromagnetic influences as a result of violation of NSC operational limits and conditions as well as consideration of probable consequences of such failures in order to meet criteria on limitation of failure consequences specified in Section 2.

2.6.3.6 Construction requirements application

Construction requirements for SSC are applied in accordance with Section 2.4.5 of the CDSD, depending on SSC safety groups and categories:

- For SSC IS-1 – SSC of category I of nuclear and radiation safety according to PiN AE-5.6 «Norms of construction designing of Nuclear Plant with different types of reactors» and category I of seismic resistance according to PNAE G-5-006-87 «Norms for designing seismic resistant nuclear plants»;
- For SSC IS-2 – SSC of category II of nuclear and radiation safety according to PiN AE -5.6 and category II of seismic resistance according to PNAE G -5-006-87;

- For SSC NIS – SSC of category III of nuclear and radiation safety according to PiN AE -5.6 and category III of seismic resistance according to PNAE G -5-006-87.

2.6.3.7 Application of fire safety requirements

Fire safety requirements for SSC are applied in accordance with NSC DCR and "Clarifications of technical requirements as regards NSC systems and auxiliary objects". SIP-P-PM-22- 460-TSN- 102-03, Rev. 3 dated 05.07.06. They are also detailed in sections 2.9.3 and 2.11.2.

Pursuant to these requirements, the categories of fire-explosion and fire spread for rooms, zones, etc. shall be specified. Category of fire resistance of buildings and structures shall be specified as well. Also classification of SSC based on impact on NRS shall be considered.

2.6.3.8 Application of power supply requirements

Power supply requirements for SSC are applied in accordance with section 2.11.3.5. According to these requirements, the categorization of power supply for consumers (systems and components) shall be carried out. Such processes have take into account impact on NRS.

2.6.4 REQUIREMENTS AND CRITERIA OF LEAK TIGHTNESS FOR NSC BUILDING STRUCTURES

One of the main functions of NSC CS-1 is provision of localization of the radioactive substances located in the OS for the purpose of minimization of their impact on the personnel, population and the environment.

Requirements and criteria on mitigation of radioactive substances exit outside the NSC protecting contour into environment at NSC normal operation and critical events are specified in item 2.6.1.

Releases and discharges of radioactive substances are possible by organized ways through systems of ventilation and sewerages, and also unorganized ways (in particular, through lacks of solidity in building structures). Further technical requirements are given to limiting releases and discharges by unorganized ways.

The main form of radioactive substances which can fall outside NSC CS-1 limits are aerosols and a dust, including:

- Aerosols and dust which currently are available in the OS;
- Additional volumes of aerosols and dust, which will be generated during activity on dismantling the OS unstable structures, during activities and to the management of attendant FCM and other RAW, and during accident conditions such as dropped loads over the central hall or collapse of the object shelter;
- Submicron fractions of radioactive aerosols, generated by the surfaces containing fuel;

During NSC operation, the radiation protection of the personnel, population and the environment will be provided with implementation of complex of measures on restriction of spreading the radioactive substances both inside NSC and outside, including (but not being limited):

- Organization of dust suppression including use of local dust suppression systems at performance of separate works on dismantling and RAW management;
- Development of ventilation and gas purification systems including organization of local ventilation in work areas with the high dust release and generation of aerosols;

- Zoning of NSC CS-1 rooms;
- Application of technologies of FCM and other RAW management providing minimum dust release and generation of aerosols;
- Packing RAW;
- Radiation monitoring of contamination of the air inside NSC CS-1 and outside;
- Acceptable level of reliability of the OS existing structures being protective barriers;
- Performance of a confining function by enclosing structure NSC;
- Decontamination measures.

Enclosing NSC structure is the last barrier on a way of radioactive substances release outside its limits that causes necessity to establish the criteria and requirements of leak tightness. The Contractor during designing will determine quantitative criteria of leak tightness.

Release of radioactive substances outside NSC limits depends, mainly, on a design of butt joints of protecting contour elements and presence of various openings, particularly:

- Joints between roofing elements of the arch and wall panels;
- Adjunction of NSC CS-1 to the OS existing structures;
- Window and doorways, gate.

The extent of air-tightness (allowable thinness) of NSC enclosing structure should be determined proceeding from criteria of radiation safety provision under normal operation and the potential accidents stated in item 2.6.1 of this document.

Designing these structures should be performed similarly to designing of structures of industrial buildings of class I [1.7.7]. Design solutions of butt joints shall exclude precipitation water penetration inside NSC.

For the purpose of monitoring of uncontrolled releases from NSC, carrying out a radiation monitoring of radioactive substances concentration in air close to the most probable places of these releases (particularly, in places of adjunction of NSC elements to the OS existing structures) is required. In case of excess of controlled levels of radioactive substance concentration in these places, it is necessary to provide possibility of elimination of the occurrence of leakages and/or implementation of other compensating measures.

The Design will address and justify the certain specific design solutions on connection of elements of enclosing structure and requirements to their control over manufacturing and erection, and may be, under operation as well. At the Design stage, with use of detailed decisions on joints and process openings, the specified calculations of uncontrollable releases will be performed and recommendations on their minimization will be developed.

The Design will (SAR) show that ingress of water from hydro-geological environment into NSC and from NSC into hydro-geological environment (unorganized discharge) is impossible or it does not result in excess of the established rules and quotas.

Constructive decisions should avoid atmospheric precipitation ingress inside NSC.

2.7 REQUIREMENTS AND CRITERIA OF TEMPERATURE AND HUMIDITY

The main requirements for NSC CS-1 temperature and humidity mode are to prevent condensation inside the confinement. The main technical measures for provision with temperature and humidity mode inside NSC CS-1 are the following:

- Supply heated atmospheric air into the Arch annular space;
- Supply a limited amount of atmospheric air into the space under the Arch.

The air supply mode and the air supply rate will ensure:

- Prevent humidity condensation in the space under the Arch and on the internal Arch surfaces;
- Prevent humidity condensation on the external surfaces of the existing Shelter to minimize generation of LRAW;
- Minimal required air supply rate to exclude dust suspension or transport.

Please see other temperature and humidity criteria in Section 2.11 and 3.2.

At the Design stage a detailed NSC CS-1 thermal analysis, considering the thermal properties of the structure, Shelter, and Arch thermal insulation of NSC CS-1 building, all thermal physics parameters of the existing Shelter and technological processes, that utilize heated water solutions. Also it is necessary to take into account moisture ingress from OS into NSC due to water evaporation taking place at OS. Thus, it is necessary to use conservative evaluations of intensity of moisture ingress from OS into NSC, assuming that 380 t of water from OS will evaporate in a year [3.27], and taking into account dynamics of this scope change depending on temperature and humidity mode in OS and NSC.

Based on the analysis results, the most optimized solutions that meet the above conditions will be proposed.

2.8 RADIOACTIVE WASTE MANAGEMENT

2.8.1 GENERAL REQUIREMENTS FOR WASTE MANAGEMENT

During development of NSC CS-1 Design, the RAW management will be reviewed under construction and its operation, including activity of NSC CS-2.

The Design of SC-1 NSC will develop a procedure for the RAW transportation to the temporary storage location on existing and built ChNPP objects as well as indicate the directions for RAW transportation, temporary storage, reprocessing and disposal.

The NSC CS-1 design scope does not include modification or addition to the systems for management of RAW applicable to existing facilities and facilities under construction on ChNPP site.

NSC SC-1 management systems of operational RAW will ensure bringing all the types of RAW to the level of acceptance at the operating and established SSE ChNPP systems.

The NSC design will develop the system for RAW management, encountered during the construction of the Safe Confinement (excavation for foundation). The NSC design will also provide for RAW management (including FCM), allocating in man-caused layer only in areas of implementation the excavator works.

The NSC SC-1 Design of RAW management system will include also a collection of liquid RAW, detected or generated in the course of NSC CS-1 construction and dismantling/ reinforcing the SC, caused by construction of NSC CS-1.

System of LRAW management will ensure collection and radiation monitoring of primary and secondary LRAW, and hand them over to the ChNPP LRAW management system, in accordance with the Employer's acceptance criteria for LRAW.

The Design of NSC CS-1 will contain the following steps:

- Quantities of waste to be generated for each classified type of waste related to the management of RAW during the NSC CS-1 and dismantling of VS-2;
- Justification of adequacy and validity of RAW sorting (PM) by classes and types, according to the criteria, given in Item 2.8.4;
- Justifications of soils application of A-S1 type (see table 2.8-2) for backfilling taking into account radioactive contamination levels in locations of foundations. The soil contamination level suitable for backfilling should not exceed soil contamination level in locations of foundations. Backfilling is carried out by the scheme: the bottom layer with use of not contaminated soil till Elevation not less than 1 m higher than the top Elevation of ground waters oscillation – average layer with use of contaminated soil of A-S1 type - the top layer (shield) from not contaminated soil of not less than 0,5 m thickness. Soils of A-S1 type are divided by criteria of suitability for backfilling depending on the place of assumed filling for A-S1-1, A-S1-2 and A-S1-3 as it is specified in item 2.8.4.

Design power required for RAW management activities and power sources will be provided in NSC SC-1 Design.

At the NSC SC-1 Design stage, in order to minimize the RAW volumes at NSC construction and operation programs will be developed of RAW minimization will be developed, including the following:

- Minimization of structural members to be decontaminated;
- Minimization of generation of secondary RAW;

- Utilization of the efficient sorting methods;
- Utilization of easily decontaminated materials.

In order to minimize the RAW volume, preference will be given to design solutions that envision minimum possible excavation of contaminated materials and equipment.

Requirements for creation of the system on management with RAW at NSC operation are also given in items .2.11.

2.8.2 SRAW MANAGEMENT

At SRAW management, the technologies will be selected on the following basis:

- Radiation and other characteristics of RAW;
- Compliance with safety standards;
- Compatibility with existing technologies applied at the OS and ChNPP and designed for NSC;
- Minimization of RAW volumes.

At the construction and operation stages of NSC and its infrastructure, SRAW management will be oriented to the maximum reasonable extent towards the existing RAW management infrastructure at OS and ChNPP.

2.8.3 LRAW MANAGEMENT

NOVARKA will develop the design of liquid RAW management system: that is, collection of liquid RAW for their removal from NSC into ChNPP RAW management system.

The LRAW management facilities will ensure collection of primary and secondary LRAW, and hand them over to the SSE ChNPP LRAW management system in accordance with the acceptance criteria.

Liquid Radwaste acceptance criteria for the ChNPP floor drain collection system and Liquid Radwaste of the ChNPP are provided in Table 2.8-1 [3.17].

Table 2.8-1. Criteria for Acceptance of Shelter Liquid Radwaste to ChNPP Floor Drain System

Parameter	Numerical value
pH	4-12
Total salt content	to 50 g/l
Total beta- and gamma-activity concentration	to 1,85·10^5 Bq/l
Total content of transuranium elements	to 3,7·10^2Bq/l
Total rigidity	to 0,2 mg-equiv/l
Sulfates	to 7 mg/l
Phosphates	to 2 mg/l
Chlorides	to 30 mg/l
Oxalates	to 3 mg/l
Petroleum products	to 2 mg/l
Surface-active substances	to 25 mg/l
Film-forming substances	absent

At excess of the above acceptance criteria LRAW from NSC special sewerage system will be transferred to the intermediate tank-receiver of LRAW preliminary processing site where LRAW will be cleaned from organic connections and transuranium elements. The site will be created within the specific SIP project. The Employer will determine locations and will give to NOVARKA the initial data on NSC special sewerage system connection to intermediate tank-receiver. The integrated scheme of management with LRAW ChNPP is described [3.17].

More thorough diagram for collection and removal of OS LRAW is present in item 3.8.2, Section 3 of the present document.

2.8.4 EXEMPTED WASTE MANAGEMENT

Any radwaste management concept anticipates separation or selective collection of non-radioactive substances, removed in NSC construction and its following operation.

NOVARKA’s activities in the Exclusion and Absolute (Mandatory) Resettlement shall be governed by reference levels, exemption levels and action levels as regards contaminated facilities as set forth in [1.6.4].

As per the “Integrated Radwaste Management Programme for the Stage of Chornobyl NPP Shutdown and Shelter Object Conversion into an Ecologically Safe System” [3.10] SSE ChNPP envisages establishment of limited contaminated substances exemption from regulatory oversight for ChNPP Industrial Site, NOVARKA shall consider the subject document in its operation following its approval.

2.8.5 PROCESS MATERIAL MANAGEMENT

During earthwork, the ChNPP contaminated soil management experience will be taken into account (construction of Change Facility, Ramp, Stroybases Utilities, implementation of stabilization measures).

According to [3.18] till the beginning of works of NOVARKA the following prime preparatory works will be executed:

- Dismantling of pioneer wall “berm” to the south of Turbine Hall, 32 m on the south from row A;
- Clearing, layout and excavations (vertical layout) for the territory of construction of NSC axial foundations.

These prime works include withdrawal and removal of a basic scope of contaminated PM. As a result of the stated works the territory of construction of NSC axial foundations will be bring up to the following status. The vertical layout (trenches for the axial foundations) is carried out till high-altitude elevation 113.5 m. Expository dose rate on the Elevation and lateral surfaces of trenches will not exceed 30 mR/hour on 10 cm distance from a surface.

Design control levels of radiation parameters for various sites for the period of construction and erection works on NSC CS - 1 creation are proved by NOVARKA in the design documentation and further are specified and detailed in works execution projects on NSC CS - 1 construction.

Management with soils and other process materials (PM) at excavations will be carried out at compliance with requirements of the document “Classification of soils and other materials resulted from the SIP ground work at the Shelter”.

According to Radioactive Substances contamination level PM are obligatory break down into the following major classes:

Class A denotes PM of Radioactive Substances low contamination level, temporary stored at a specific area within SSE ChNPP site. It is equipped for PM temporary storage according to the design subjected to approval by SSE ChNPP and agreement by regulatory bodies. Part of the PM of such class can be released for further construction of the SIP facilities.

Note. The definition of temporary storage in this document does not include the process of PM accumulation up to amount sufficient to load a transportation truck and carry it to either temporary or final disposal. The technological process and relevant criteria for PM accumulation are defined in the management plan for soil excavation.

Class B denotes PM of Radioactive Substances intermediate contamination level which is disposed at near surface storage. In case if part of PM cannot be disposed it becomes a subject to containerization, temporary storage, and subsequent disposal in compliance with requirements for Intermediate RW (IRW).

Class C denotes PM of high contamination level of Radioactive Substances, which radiological characteristics relate to HLRAW. Such PM are stored at the temporary HLRAW storage at SSE ChNPP industrial site.

PM breakdown within major classes:

- Type A-S1 – soil which radiological and technological characteristics fits for construction of the SIP facilities;
- Type A-S2 – soil which radiological/technological characteristics does not fit for construction of the SIP facilities;
- Type A-T – man-made materials (concrete, metal structures and other similar objects).

PM referred to a type of “soil” can include small size man-made inclusions. The maximum size is determined and justified by the design documentation.

In Class A it is acceptable to separate PM from the other types which are subjected to entire exemption from regulatory control (type A-R). It is not obligatory that PM of A-R type be placed at the interim storage site.

A-S1 soils are divided into A-S1-1, A-S1-2 and A-S1-3 in accordance with the backfilling criteria depending on the site for the provided backfilling.

If transportation of certain A-T types to the temporary storage leads to significant delay in the excavation SSE ChNPP is entitled to make a decision to relocate this material beyond the work area and store it nearby. If necessary, appropriate radiological protection shall be provided. SSE ChNPP Resident Inspection and Chief Sanitary Doctor must concur with this decision.

Listing of radiation criteria according to which PM are segregated includes the following parameters:

- EDR- exposure dose rate (maximum value at 1 m distance from PM);
- $A_{v\alpha}$ - specific volumetric activity of alpha-emitters;
- $A_{v\beta\gamma}$ - specific volumetric activity of beta- and gamma-emitters;
- $A_{s\alpha}$ - specific surface activity of alpha-emitters;
- $A_{s\beta}$ - specific surface activity of beta-emitters.

$A_{s\alpha}$ and $A_{s\beta}$ parameters are used only for PM without volumetric contamination.

PM are segregated in accordance with the numerical value of radiation criteria as stated in Table 2.8-2.

Table 2.8-2. Numerical values of radiation criteria for PM segregation

Class PM	Type PM	EDR, mR/h	$A_{v\alpha}$, Bq/kg	$A_{v\beta\gamma}$, Bq/kg	$A_{s\alpha}$*, Bq/kg	$A_{s\beta}$*, particle/cm²·min
A	A-R	Up to 0.03	Up to 100	Up to 10^4	N	N
	A-S1-1	Up to 1	N	N	N	N
	A-S1-2	from 1 Up to 10	N	N	N	N
	A-S1-3	from 10 Up to 30	N	N	N	N
	A-S2	from 30 Up to 50	N	N	N	N
	A-T	Up to 50	N	N	Up to 80	Up to 8000
B		from 50 Up to 1000	Up to 10^8	Up to 10^{10}	Over 80	Over 8000
C		Over 1000	Over 10^8	Over 10^{10}	N	N

** - Parameters $A_{s\alpha}$ u $A_{s\beta}$ are used exclusively for PM which has no volume contamination*

N - Not regulated.

Class B of PM is also segregated in accordance with radiation criteria at least up to the near-surface storage facility.

Radiation contamination of AT PM which can be timely located at the territory near the work implementation zone should not exceed the reference levels established for this territory.

Methodologies and scopes of dosimetric monitoring which allow us to segregate PM in accordance with the established radiation criteria with the required accuracy and reliability are determined and justified by the design documentation. In particular, it is stated and justified the volume of PM in accordance with which the monitored parameters are averaged.

NSC CS-1 should not create essential obstacles to removal of technogenic soil inside and outside NSC at subsequent NSC operation phases.

2.9 INDUSTRIAL SAFETY REQUIREMENTS

2.9.1 INDUSTRIAL SAFETY

The technical solutions in the design will be developed taking into account the requirements of NLD and ND in the area listed in Attachment A2.1

Section of the Design will be developed in format and scope sufficient for justification of safety provided in documents relative to fire and industrial safety and protection of labour.

It will be taken into account, that NSC in respect to ensure the industrial health and safety are characterized by the following specifics:

- Unstable Shelter structures;
- Complex radiological conditions that require high intensity of work performance and sufficient turnover of workers;
- Utilization of non-standard technologies, equipment, tools and devices.

The industrial health and safety will cover the following areas:

- Electrical safety;
- Protection against fall, collision and touching structures/components in the access routes and at work sites;
- Protection from possible structural collapse, load falls;
- Protection from toxic or chemically active material (including chemical substances, to prepare decontamination and dust suppression/fixative dust and airborne particles);
- sufficient lighting of work places;
- provision of the required climatic conditions at the work places (temperature, humidity);
- Protection of other hazardous and detrimental industrial factors.

The main criteria for industrial safety are as follows:

- Non exceeding the maximum allowable parameters and characteristics of hazardous and detrimental factors included in the normative documents:;
- Organization of the industrial safety to prevent deterioration of radiation parameters at WP during fulfilling of works.
- Meeting requirements for work organization, aimed at ensuring health and safety, requirements for equipment and processes, requirements for structures in terms of safety assurance, and requirements for safety equipment.

The industrial safety actions will be compatible with the radiological protection approach.

2.9.2 INDUSTRIAL SAFETY AND LABOUR PROTECTION DURING CONSTRUCTION AND ASSEMBLY WORKS

During implementing the NSC CS-1 buildings and assembly works based on the normative documents, Program of provision with the industrial safety and labour protection during SIP projects [1.12.13] each NOVARKA will develop and transfer for ChNPP submittal the Program of the Contractor’s labour (LPP) taking into account the specific features of contract works.

LPP will be a main program, describing in a whole the program of labour protection, containing information about NOVARKA's safety system applied during the work implementation, measures which will be used in order to obtain a guarantee for everybody for observance of this program and the way of the program realization by all the participants. At the least, LPP will contain the following data:

- Purpose of Program;
- General description of the scope of work and scheduled contract measures;
- Distribution of duties and subordination under supervision of the industrial safety;
- Main safety measures and precaution during work implementation;
- Provision of measures for NOVARKA safety;
- Main requirements for the personnel training;
- Requirements to availability of required personal protective equipment;
- Common approach to required training and certification of workers and managers;
- Necessary documents for compliance testing/ inspection of construction equipment;
- Description of medical care, available at the site and coordination with other services;
- Order of notification about the incidents relative to safety, including the telephone numbers of Contractor's contact persons;
- Emergency response and order of evacuation.
- Official responsible to implement the S&H regulations.

Besides, the special labour protection programs for works implementation will be developed as a part of each Design for Work Execution Plan (WEP). Before start up of activity at the site, the requirements for safety assurance with SSE ChNPP will be agreed. Section of WEP subjected to safety assurance will contain, at the least, the following:

- Brief description of the work scope and designed WEP measures ;
- Analysis of risks with indication of well-known and assumed dangers, including the industrial and radiation risks;
- Specific safety protection measures during work implementation;
- Any changes of LPP, relative to arrangement of safety assurance measures at the industrial site;
- Specific requirements for the personnel training;
- Required individual protection means, including the determination of their number and source of delivery (Contractor or SSE ChNPP);
- Requirements to qualification of workers (riggers/crane operators/welders, etc.);
- Required documents for compliance testing/ inspection of construction equipment;
- Description of applied hazardous chemicals, their effect on human body; personal protective equipment; management of these substances;
- Description of potentially hazardous equipment, list of required protective devices and blocking devices;
- Measures to mitigate the potential risk if there are no hoisting mechanisms in the OS for the workers manually relocating cargo;

- Measures to mitigate the effects of extreme temperatures;
- Official responsible for safety assurance.

WEP for construction will be developed by NOVARKA. WEP contains the detailed description of works; work order ands safety justification. WEP will include the safety assessment of works to be performed. It specifies the work-dependent dangers and feature proposed to decline the risks.

NOVARKA will assume the measures necessary for the personnel access to the Exclusion Zone and the industrial site.

NOVARKA will be responsible for his personnel arrival to the site with corresponding PPE and LP technique indicated in WEP. Work of the personnel at the industrial site without appropriate means and LP facilities is forbidden. All the delays caused by the lack of such means will be the responsibility of NOVARKA.

NOVARKA will determine types and number of the individual protection means and LP technique which are required to fulfil their scope of works as well as to provide its availability.

2.9.3 FIRE PROTECTION

Based on the requirements of normative documents, the category of fire explosive and fire danger, will be determined in the Design. Category of rooms according to fire explosive and fire danger, and fire –resistance characteristics for building structural will be specified during NSC CS-1 Design phase. Reasoning from the OS status as radiation and nuclear –dangerous object and taking into account the specific features and value of the fire load of it, concrete requirements for fire safety subsequent upon ND, which set forth in Attachment 2.1, Norms and standards, will be considered and justified.

Reasoning from potential fire impact onto radiation and nuclear safety, fire safety provision in the NSC rooms will be realized in the course of its design and construction due to the performance of technical and organizational measures. Criteria of technical fire-resistance measures will be, as follows:

- Provision with high level functioning reliability of the protected facilities, affecting the radiation and nuclear safety due to reservation and physical division accompanied with fire – protection barriers;
- Creation of fire alarm system and fire fighting system;
- Assurance of high-level reliability for the fire-proof systems and equipment due to reservation, division of functioning channels, functioning dependability of various fireproof means.

NSC is attributed to 1st category of fire resistance, and category of fire explosion and fire danger will be considered in compliance with [1.3.15].

Based upon the fire danger analysis the main organizational and engineering measures on NSC fire safety assurance in compliance with operating normative documents of Ukraine will be developed at the subsequent design phases.

Measures on fire safety assurance realizing in the course of the NSC construction will correspond to the Ukrainian operating fire safety requirements.

Taking into account that the fire may have a potential impact on the NSC radiation and nuclear safety, fire safety measures will be developed taking into consideration the following main principles of “defence in depth” principles:

- Fire prevention;

- Early detection and effective extinguishing of fire;
- Prevention of fire spreading outside the permissible boundaries, if the fire was not extinguished on time.

The single failure principle will be taken into account, as fire is viewed as a specific impact and an initial internal or external event. It is also assumed that two or more fires may not occur simultaneously.

Fire will be prevented through prevention of combustible medium generation and/or prevention of ignition sources within combustible medium.

The combustible medium will be provided through one of the following measures or their combination:

- Maximum possible utilization of non-combustible or limited combustible substances and materials;
- Limiting amounts of combustible material, located locally; arranging them in the most safe way (to prevent generation of dangerous airborne mixes with excessive explosion pressure, exceeding 5 kPa);
- Enclosing combustible media (special fire chambers and compartments, use of insulated chambers, cabins);
- Maintain explosion safe combustible concentration;
- Install fire hazardous equipment in isolated rooms (fire chambers and compartments);
- Utilization of devices that protect production equipment with combustible materials from damage and accidents;
- Install breakers, switches, shutoff valves and other equipment (also on ventilation ducts).

The generation of ignition sources within the combustible medium will be prevented through one of the following measures or their combination:

- Utilization of plant and equipment (also for erection purpose), that does not have the ignition sources;
- Utilization of electric equipment designed to operate in the fire/explosion hazardous areas;
- Utilization of quick response systems that turn off possible ignition sources;
- Observation of electrostatic safety regulations;
- Lightning protection;
- Utilization of spark free tools in working with combustible liquids and explosive dusts;
- Eliminate conditions for thermal, chemical and/or microbiological spontaneous combustion of the process combustible materials.

Fire prevention will be performed through the main following activities:

- Implement organizational measures, including works performance regulations at detail design stage;
- Apply fire safety technologies of work implementation;
- Utilization of fire rated construction material with standard Category I of the fire resistance at NSC CS-1 Design stage;
- Apply incombustible cable (for instance, with index НГ) and conduct materials; install cables through, fire barriers, and insulate cables with fire-resistant coating;

- Minimize the amount of combustible and explosive substances and materials at detailed design stage;
- Minimize fire load on the new NSC structures at detailed design stage.

Early detection and effective extinguishing of fire will be ensured through the following:

- Equip NSC rooms with automated fire alarm system , as required ;
- Equip NSC rooms with fire extinguishing system, including automated system, as required;
- Equip technological and auxiliary NSC facilities with the smoke protection system, that shall primarily exhaust smoke and/ or provide for positive air pressure along personnel evacuation routes;
- Equipment all regularly and periodically rooms and working places with fire extinguishers depending on the purpose of premises and nature of fire load;
- Install automatic water curtains in passages from old OS structures to the new ones and in the passage to the Unit3 at detailed design stage, as required;
- Equip NSC rooms with fire hose cabinets provided with primary fire extinguishing means and fire hoses, shut-off valves and nozzles
- Ensure prompt notification and evacuation of workers;
- Utilization of personnel safety equipment at detailed design stage.

Fire alarm system, warning system, fire extinguishing system and system of smoke protection will be integrated with each other and ventilation systems.

Prevention of fire spreading beyond the permissible boundaries will be assured through the following:

- Implement design and process solutions according to the requirements of current fire safety normative documents;
- Localize fire through creating fire-resistant barriers and/or fire zoning;
- Equip ventilation systems with automatic fire dampers, preventing fire expansion to the adjacent rooms.

The detailed requirements and design criteria of fire safety are laid down in section 2.11.

The detailed evacuation plans will be developed to protect the personnel from fire at the NSC CS-1 Design stage. The access routes for fire subdivisions and fire equipment will be designed at the same stage.

The Design will address to fire prevention measures required to provide the Site with temporary or permanent fire water sources, access roads and passages. In addition to that, demolition of facilities that are not used in the construction process and do not have required fireproof baffle walls will be assumed, as required.

The Site and working places will be furnished with the adequate number of primary fire - extinguishers in accordance with the appropriate regulations. The access roads and fire-fighting vehicle lots will be constructed along the NSC outside perimeter.

2.10 ENVIRONMENT

The objective of the EIA is the determination of reasonability and appropriateness of the NSC design decisions including activities during the preparatory period, construction, commissioning, operation (including dismantling of unstable structures, further routine operation and possible removal of FCM and other RW) and it’s decommissioning with substantiation of commercial, technical, organizational, sanitary, state-legal and other measures on environment safety assurance.

NOVARKA will submit an Environmental Impact Assessment (EIA), developed on the basis of the existing EIA for the Conceptual Design, together with the design together with other safety related documentation: Safety Analysis Report (SAR) and Sanitary Compliance Report (SCR).

The EIA of the NSC will be developed in accordance with DBN A.2.2-1-2003 “Structure and contents of the environmental impact assessment (EIA) materials during design and construction of enterprises, buildings and facilities” [1.6.1].

The EIA-NSC will be developed taking into account the existing Object Shelter (OS) as well as projects envisaged for implementation at the OS within the SIP as the NSC components. In particular, EIA-NSC will analyse and provide information on the facilities, systems and components (FSC) existing and being created at the OS to be used in the NSC.

The EIA-NSC will:

- Demonstrate integration of the OS FSC and NSC;
- Apply comprehensive approach to analysis of the NSC environmental safety, considering the OS as the NSC component.

EIA-NSC will be developed based on the following:

- Effective Ukrainian environmental legislation;
- NSC design documents (DD-NSC);
- Design criteria and requirements (DCR) for the NSC concurred by the Ministry of Environment;
- Strategy of further NSC implementation concurred by the Ministry of Nature;
- Programmes and plans for safe activities at the OS concurred by the Ministry of Nature, including radioactive waste (RW) management program.

Comments and recommendations by the Ministry of Nature will be addressed, including those of the expert conclusions.

Justifications in the EIA-NSC will be provided step-by-step for separate parts of the NSC design, in compliance with sequence of its construction, commissioning and operation as determined in the “Strategy of further NSC implementation” [1.12.11]. In the progress of the Strategy implementation EIA-NSC will be revised and completed. Sequence of development (revision, completion) of EIA-NSC is described in the “Licensing Plan during the NSC project implementation” (LP-NSC) that is attached to the “Licensing Plan during realization of the Shelter Implementation Plan projects at the “Shelter” Object of the SSE Chernobyl NPP. Phase 2” (LP-SIP).

The EIA-NSC will provide the following:

- Detailed justification of compliance with the requirements of environmental legislation of specific stages of the NSC commissioning stages creation and respective conversion of the OS as well as specific types of activities and operations during these stages;
- Justification of compliance with the requirements of environmental legislation in principle during the further stages.

This is related to the following NSC commissioning and the OS conversion stages:

- First NSC commissioning stage “protective facility with process life-support systems and needed infrastructure”;
- Second NSC commissioning stage “infrastructure for dismantlement of the OS unstable structures” and respective stage of the OS conversion “early dismantlement”;
- Further NSC routine operation;
- Third NSC commissioning stage “technologies and infrastructure for removal of fuel containing materials (FCM) and other RW and their further management” as well as respective stage of the OS conversion “FCM and other RW removal”;
- NSC decommissioning.

Where information explaining and illustrating the data provided in the EIA-NSC is summarised in the DD-NSC, references to the respective parts of the documents will be provided.

Links will be established between EIA-NSC and SCR proving compliance with the sanitary legislation, as well as SAR-NSC justifying ensuring of the nuclear and radiation safety (NRS).

On this basis, it is noted that:

- Output data used for NRS, environmental safety and sanitary and hygiene justification is provided in the separate integrated document;
- Summary of the certain EIA-NSC sections with references to the respective components of EIA-NSC or SAR-NSC is provided, if these components contain required justification.

2.11 TECHNICAL REQUIREMENTS AND CRITERIA FOR DESIGN OF TECHNICAL AND PROCESS SYSTEMS

NOVARKA will design:

- Monitoring and control systems of NSC CS-1;
    - Integrated control system (ICS);
    - NSC Monitoring systems:
    - Radiation monitoring system (RMS);
    - Structures & Foundation Monitoring System (SFMS);
    - Seismic Monitoring System (SMS).
- Fire Safety System of Arch and Auxiliary NSC Facilities;
- Process and Operation Support Systems of Arch and the Auxiliary Facilities:
    - Internal Transport system;
    - System of Heating, Ventilation and Air Conditioning;
    - RAW Management system;
    - System of Power Supply and Equipment;
    - System of Communication and Industrial TV;
    - System of Water Supply and Sewage;
    - System of Sanitary Treatment of Personnel and Decontamination.
- Auxiliary facilities.

The reservations made for the CS-2 are provided in section 3.7.

2.11.1 MONITORING AND CONTROL SYSTEMS

2.11.1.1 General Requirements for Monitoring and Control Systems

The control and monitoring systems together with technological, electrotechnical and other systems will ensure nuclear, radiation and industrial safety, reliable and efficient operation of process equipment.

The monitoring systems will be designed with rely on an optimised to minimize manufacturing and operating costs, as well as to minimize personnel doses in installation, maintenance and repair of systems components in high-radiation areas. Possible configurations of the monitoring system will be analyzed; the most optimal ones will be selected on the ALARA basis.

2.11.1.2 Integrated Control System

In compliance with par. 20 of Appendix 2 to the Strategy, the NSC Commissioning Stage-1 (CS-1) Contractor will provide the following:

1. ICS (upper level):

- All necessary equipment, equipment of the central and, if necessary, local control panels (excluding local panels intended for controlling the dismantling process) considering NSC CS-1 needs;
- NSC CS-1 integrated control;
- Back-up equipment and connection points of NSC CS-2.

2. ICS (lower level):
    - SMS – completely;
    - SFMS – completely;
    - RMS – equipment taking into account needs of both commissioning stages; radiological monitoring of NSC CS-1, connection points of additional instrumentation channels for NSC CS-2;
    - Crane equipment monitoring and control system – completely;
    - NSC operation support systems (NSC CS-1 considering needs of NSC CS-2).

As a minimum, the lower-level ICS for NSC CS-1 will be composed of the following systems:

- Radiological monitoring system (RMS);
- Seismic monitoring system (SMS);
- Structural monitoring and foundation monitoring system (SFMS);
- Crane equipment monitoring and control system;
- NSC CS-1 operation support systems:
    - Heating, ventilation and air conditioning system;
    - Water supply and sewage system;
    - Electric power supply system;
    - Dust suppression system;
- System of control and technological processes management (as required) at the level of connection with Central control panel of data management about basic parameters and faults in the equipment components of these systems with possibility of their start/ stop.

The criteria and requirements in this section apply to the scope of the upper-level ICS.

The NSC ICS will be designed taking into account interconnection with the Shelter Integrated Automated Monitoring System (IAMS) and Integrated Shelter Database (ISDB) being developed under SIP Tasks 17 and 18. To support the data link between the NSC ICS and Shelter IAMS, an appropriate server may be proposed.

The NSC ICS will interface with the following independent systems:

- Fire safety system;
- Access control system.

The NSC CS-1 ICS will provide continuous monitoring and control of various NSC systems for the full lifetime of the NSC. This will be achieved by developing a system that is open (i.e. limits the use of proprietary devices, interfaces and protocols), extensible, modular, reliable and secure.

For the operation support systems, permanently attended local control panels will be envisioned. The other systems that are spread over the facility, as well as systems that are controlled from the local control panels, will be controlled from the Central Control Panel (CCP).

Control is defined as monitoring, automated and remote control, technological protection and blocking, alarm and filing of information.

The Head Facility Operator will be stationed at the CCP. The local control panels will have workplaces for operators of individual systems.

The monitoring systems will be distributed, multifunctioned, providing with data processing, and will be intended for permanent real-time performance.

The monitoring systems will be operated independently and provide for collecting, processing, accumulating, displaying, analyzing and filing the data inputs, issuing the reports and perform other necessary functions.

The following requirements will be met:

- The systems will have a modular structure and self-diagnosis function to provide for prompt detection and elimination of faults;
- The systems will be opened, i.e. provide for extension of the functions and the number of parameters monitored;
- The principles of permanent memory and emergency backup will be used for data storage.

The systems will ensure:

- Alarm signals when operating limits of monitored parameters are reached or exceeded;
- Transfer of processed data to the upper-level system;
- Filing of data when the upper-level systems fail.

ICS Architecture

The ICS will constitute a fully integrated, microprocessor-based control and monitoring system having a functional configuration and shall be physically distributed.

The system will have a user-friendly graphical interface for viewing geo-schematic representations of the NSC subsystems and will also support methods to easily create and maintain databases and displays required for operation.

The ICS will be an “open” system in compliance with [3.10], as well as have the ability to operate on a variety of computer hardware platforms and support a variety of communication protocols.

The ICS will have functionally and geographically distributed architecture comprised of similar satellite programmable logical controllers (PLC) and data acquisition units linked to human machine interface units on the central and local control panels by a redundant high-speed local-area network. The number of panels will be adjusted to minimize field wiring and provide local control on a subsystem basis during the NSC CS-1 Design Phase. The NSC CS-1 design will examine zones where field panels are to be placed, including panels for future NSC CS-2 systems.

The system will be designed so that any operator’s station can be configured to read inputs/outputs for any controller on the data highway. Operator screens will be in Russian language. System controllers will be impervious to power interruption.

Each ICS panel will be provided with an uninterruptible power supply (UPS) capable of 90-minute continued operation of the ICS after power loss. PLC distributed throughout the process

will utilize dedicated UPS sized to provide continuous operation for 90 minutes after a total electric power failure. As an alternative, the Contractor may propose central uninterruptible power supply for the system.

The power units will be mounted and housed in the same control enclosure with PLC if possible.

The UPS units will permit full operation of the processor, I/O and operators' screen for a time after a complete voltage failure.

The process logic, both analog and discrete, will be executed by local mounted PLC. The control panels will be located at CCP or local points to minimize field cabling.

Controller that are used for critical or safety related logic will be triple modular redundant (TMR). TMR is a fault tolerant control system that identifies and compensates for failed control system elements and allows repair while continuing an assigned task without process interruption.

TMR employs three isolated, parallel control and diagnostic systems integrated into one system. The system uses 2-out-of-3 voting to provide high-integrity, error-free uninterrupted process operation with no single point of failure.

Redundancy of field instrumentation is not envisioned at this time but will be examined more closely during the NSC detailed design phase. Non-safety related data will be controlled by conventional simplex PLC's controls.

The systems will be designed with use of industrially-tested hardware. New hardware will be applied only after in-situ or field testing.

Peer-to-peer communication will be handled by a redundant high-speed local area network (LAN).

To eliminate dependence on the communication network, all safety interlocks for a given technological process will be restricted to a single PLC processor/chassis. Safety interlocks between technological systems will be implemented with discrete, hardwired inputs and outputs so that interlocks will not be compromised by LAN performance or failure. This includes such items as emergency trip initiators and protective devices for equipment.

ICS software will be configured around open and easily maintained software products; application of custom-made solutions is not recommended. The main operational system for servers and workstations is Microsoft Windows.

Data exchange between PLC, operators' workstations and other NSC subsystems will be carried out using OLE technologies.

The graphic interface of operators' workstations will be provided by a configured standard application with graphic user interface and working with use of OLE program technology.

Control system configuration/programming will follow programming guidelines adhere to four languages: Function blocks, Structured text, Ladder logic и Sequential function charts.

ICS protection system includes protection means of hardware and software.

The ICS access control system will use as a minimum a multilevel password system. The ICS will be protected from intrusion from external systems by a data tracing and management system via firewall protection. Telephone line modems will be treated as external systems.

2.11.1.3 Radiological Monitoring System (RMS)

The radiological monitoring system (RMS) will ensure the monitoring of parameters of characteristics of radiation sources in order to determine doses to people and radiation situation of industrial and natural environment. This section describes basic criteria and requirements related to the scope of NSC radiological monitoring. This does not concern the radiological

monitoring program as a whole since Shelter monitoring is provided by other systems, with which interface shall be established.

NOVARKA will provide a full-range RMS adequate for protection of personnel and the environment in operation and maintenance of equipment, systems and facilities of NSC CS-1. The RMS will assume for a reserve for NSC CS-2, as shown below.

The NSC CS-1 design will assess the interface with SIP Task 17. The NSC CS-1 design will determine the primary solutions for the radiation monitoring system for the NSC, including NSC CS-1 construction and operation. The radiological monitoring system will be extendable to cover NSC CS-2 tasks.

Basic Criteria and Requirements for Radiological Monitoring (RM)

The types and scope of measurements of monitored parameters will be determined in accordance with requirements [1.2.3]. In accordance with 7.1.1.4 [1.12.8], the requirements of [2.1.1] will be applied only if they do not contradict sanitary legislation documents developed after the implementation of [1.2.1, 1.2.2, 1.2.3], taking into account specifics of NSC construction, commissioning and operation.

The design will determine the scope of radiological monitoring in the NSC including:

- Types of radiological monitoring;
- Objects of radiological monitoring;
- Monitored parameters and their permissible and control levels;
- A networks of monitoring points and frequency of radiological monitoring;
- Radiological monitoring hardware and methodic support.

The following types of radiological monitoring will be envisioned:

- Process radiological monitoring;
- Dosimetry radiological monitoring;
- Radiological monitoring of radioactive contamination confinement;
- Environmental radiological monitoring (regarding releases and effluents).

It should be noted that NOVARKA will provide appropriate equipment. NOVARKA will consider potential installation of additional equipment by future contractors at a later stage.

According to [1.2.3] and other regulatory documents of Ukraine, the radiological monitoring system of NSC CS-1 will ensure monitoring to be sufficient for the needs of operation and maintenance of CS-1 equipment, systems and facilities (excluding the needs for dismantling operations – NSC CS-2), as follows:

- Personnel and individual protection means;
- Personnel workplaces;
- Rooms where operations take place and adjacent rooms;
- Access routes;
- Air locks, sanitary locks;
- Technological process, in particular, involved operating media (see note below);
- Equipment (stationary and portable) (see note below);

- Transportation vehicles;
- Radioactive waste (see comment below);
- Airborne releases;
- Liquid effluents;
- NSC site (see note below).

Note 1. NOVARKA will not be required to provide instruments and portable and stationary equipment for radiological monitoring of technological operations related to dismantling of Shelter unstable structures and handling of these structures. Nevertheless, the Contractor will take into account possible setup of such instruments and equipment to be mounted later by the NSC CS-2 Contractor. The RMS will provide for the connection of such equipment and the performance of functions with respect to this equipment.

Note 2. The scope of supply to be provided by NOVARKA will not include regular, portable instruments, not connected to the RMS, for radiological monitoring of technological operations related to dismantling of Shelter unstable structures and handling of these structures.

The following parameters will be monitored:

- γ dose rate: in NSC rooms (in areas, access routes, sanitary check points, sanitary locks and other rooms) by zones; from process equipment, operating media; near protective barriers; on site;
- Activity concentration (α, β, γ - activity) of radioactive aerosols in rooms NSC(such as areas, access routes, sanitary check points, sanitary locks) by zones and on site;
- Activity and radionuclide composition of airborne releases through ventilation systems and leaky parts (release through leaky parts can be estimated by measuring the specific activity of air near leaky parts and evaluating the maximum rate of air leak);
- Activity and radionuclide composition of discharges from the NSC;
- Activity and radionuclide composition of environmental samples (air, soil, groundwater, contamination samples) on the NSC site based on the existing system;
- Activity, surface contamination and radionuclide composition of radwaste generated (solid, liquid);
- Degree of radioactive contamination (α, β -flux density) on surfaces of industrial rooms (for example areas, access routes, air locks, changing facilities), equipment, territory and on-site facilities;
- Degree of radioactive contamination of transportation vehicles when crossing boundaries between different zones and NSC territory;
- Individual doses (external and internal exposure) to personnel;
- Degree of contamination of skin, footwear, working and personal clothes, IMP of personnel.

According to [1.2.3], Section 14.2.1, the following hardware for radiological monitoring will be used:

- Hardware for radiological monitoring of the technology, territory and workplaces (see note 1 above);
- Hardware for prevention of potential exposure to personnel (sensors, emergency alarm systems etc.), which is provided with interface for controlling protection, interlock and access elements;

- Instrumentation for individual dosimetry monitoring of personnel (stationary, portable and transportable);
- Dosimetry, radiometry, spectrometry and radiochemistry equipment.
- Computer environment with software for storing and processing primary data, calculating and planning personnel individual doses, keeping a database of doses and radiological parameters.

The sufficiency of hardware will be justified taking into account ChNPP existing technical means and those purchased within the SIP.

According to [1.2.3, item 14.4.4], the following hardware will be used to monitor the industrial environment:

- Hardware for continuous monitoring based on readings of stationary automated technical means;
- Hardware for monitoring based on readings of individual, portable and transportable technical means;
- Hardware for laboratory analysis based on readings of stationary laboratory equipment, means for sampling and treatment of samples for analysis.

The sufficiency of hardware will be justified taking into account ChNPP existing technical means and those purchased within the SIP

Radiological monitoring devise with automatic audible and visible detectors will be installed in places where radiation sources are dealt with, which have kerma equivalent to more than 1 $mGy \cdot m^2 \cdot s^{-1}$, and in working areas where radiological conditions can substantially change ([2.1.1], Section 14.4.6).

Air monitoring is needed in all cases in normal or emergency conditions involving potential inhalation intake of radionuclides, leading to the annual effective dose more than 1 mSv ([2.1.1], Section 14.4.7).

The scope and periodicity of monitoring will ensure detection of the exceeding of reference levels in measured parameters at monitored facilities. Design permissible levels for the NSC and NSC workplaces will be determined in compliance with the [1.2.6].

The Contractor will provide a full-range RMS adequate for protection of personnel and the environment in operation and maintenance of equipment, systems and facilities of NSC CS-1. The Contractor will address the needs of NSC CS-2, as defined in Attachment 2. s.20 [1.12.11], specifically:

- Reserve power for RMS equipment needed for NSC CS-2;
- Connection points of additional instrumentation channels for NSC CS-2.

The Contractor will provide for a reserve to facilitate future connection of instrumentation channels for the NSC CS-2 RMS. This includes a reserve for radiological monitoring equipment and connection points, in particular, sensors, data acquisition units, computer capacities, inputs/outputs, circuits with a reserve for future cables, wall penetrations, terminal boxes etc., in order that the NSC CS-2 Contractor is able to incorporate these functions and instrumentation into the radiological monitoring system.

Based on cost/benefit analysis, the NSC RMS will make the maximum use of the Shelter existing portable (individual, transportable) equipment. There are examples of such equipment:

- Portable equipment used to measure surface contamination of containers with waste and trucks with waste, and to measure radiation inside the driver's cab;

- Portable equipment to monitor α- and β-radiation to be used for surface monitoring in zones 1, 2 and 3;
- Portable equipment used to monitor smears taken at NSC facilities and areas of truck loading and exit control;
- Portable equipment to monitor γ dose rate;
- Portable equipment to monitor air contamination.

If the existing portable equipment is insufficient, the Contractor will provide additional equipment to suit the scope needed for CS-1 operation. Decisions to replace or use existing equipment will be based on cost/benefit analysis.

The above-mentioned also relates to other components of the personnel dosimetry monitoring system and laboratory analysis equipment available at the OS.

2.11.1.4 Structural Monitoring and Foundation Monitoring System (S&FMS)

The S&FMS shall monitor the horizontal, vertical and rotational displacements of the foundations. The S&FMS will include embedded survey control points on the pile caps and along the west wall and located external to the structure. The location of the embedded survey control points will permit determination of foundation translations and rotations. A topographical levelling from an invariable base of these control points will permit measurements of the movements and determination of their velocity. Relative movements of the survey control points located on the NSC foundations will be measured from fixed survey monuments to be installed by the Contractor and from existing survey monuments. The frequency of the survey measurements will be adjusted depending on the rate of foundation displacements.

Since the NSC arch structure shall be designed for a 100-year service life with a minimum of maintenance, it is unlikely that a structural monitoring system of the arch will provide the Client with useful data. Due to its size and flexibility, the arch structure will undergo large displacement and rotations every day due to variations in air temperature, solar radiation, wind and snow loads. The arch structure is highly dependent upon the stability of the foundation; therefore, structural monitoring will be mainly concentrated on the foundations. Survey targets will be placed at strategic locations of the arch structure so that nominal benchmark local data (nominal readings of the survey targets) can be recorded shortly after completion of the NSC.

The Contractor will optimize technical solutions regarding the use of specific instrumentation and take into account radiological situation in locations of sensors.

The system does not interface with the NSC CS-2 design. The S&FMS will function in full scope and be complete after finalization of the NSC CS-1 operations.

2.11.1.5 Seismic monitoring system (SMS)

The basic solutions for the seismic monitoring system will be established during the NSC design. The system will monitor the seismic response of the arch structure and foundations. The design of the seismic monitoring system will include the monitoring of soil (free field-site that is not affected by surface or near-surface structures) and NSC seismic response. The NSC seismic monitoring system will be interfaced with the IAMS.

The system will include at least one sensor of seismic acceleration, amplitude, frequency and direction of soil oscillations around the NSC (free field) and sensors located in selected points of the foundation and arch structure. These sensors will be sufficient to characterize the seismic response of the foundations and arch structure. If the IAMS includes provisions for respective monitoring of the free field, additional sensors may be not required for this purpose.

The SMS will ensure the collection and processing of seismic data on acceleration, amplitude, frequency and direction of oscillations of soil, NSC foundations and structures near monitoring points, and ensure the transfer of data as processed.

NOVARKA will be required to optimize technical solutions for application of specific monitoring equipment and take into account radiological situation in locations of sensors.

The system does not interface with the NSC CS-2 design. The SMS will function in full scope and be complete after finalization of the NSC CS-1 construction.

2.11.2 FIRE PROTECTION SYSTEMS

NSC CS-1 fire protection systems will include passive and active systems.

Passive fire protection systems include:

- Fire barriers;
- Fire chambers and compartments;
- Personnel evacuation routes.

Active fire protection systems include:

- Automated fire alarm system;
- Automated fire fighting system;
- Fire notification and evacuation system, fire brigade notification system;
- Smoke protection and ventilation system;
- Fire water supply system;
- Primary fire fighting means.

According to appendix 2 (item 9 and item 19) of the Strategy NOVARKA should provide fire protection systems for NSC CS1 and to take into account needs of NSC CS2 thus to stipulate:

- Automatic Fire Alarm System (AFAS) taking into account needs of CS-1 and CS-2;
- Automatic Fire Warning System and Evacuation (including notification of fire guard);
- Automatic Fire Extinguishing System for CS-1 and CS-2;
- Smoke protection and ventilation system taking into account needs of CS-1 and CS-2;
- Primary fire-fighting facilities considering needs of CS-1and CS2.

Integration with existing OS and ChNPP systems. It is necessary to note, that the Contractor's scope does not provide any improvements or changes of existing or future ChNPP site or OS fire protection systems, except for connection to them and diversion capacity.

Fire water supply system, including: all necessary equipment taking into account consumers of both commissioning stages and arrangement of corresponding rooms and sites.

2.11.2.1 General Technical Requirements for Passive and Active Fire Protection Systems

2.11.2.1.1 <u>General Technical Requirements for Fire Barriers</u>

The purpose of fire barriers is to prevent the propagation of a fire by its confinement within the rooms separated by these barriers within an established period of time.

Fire barriers include fire walls, partitions and coverings. Fire doors, gates, windows, hatches, valves and curtains (shields) are used to fill openings in fire barriers. Fire lock chambers may be also located at openings.

In accordance with [1.3.18], fire barriers are characterized by fire resistance and capability to prevent fire spreading.

The fire resistance detector is represented by fire endurance of a structure, which is determined by the period of time (in minutes) from the beginning of a fire test based on a standard temperature mode to a limiting state of the structure, as follows:

- Loss of carrying capability (R);
- Loss of integrity (E);
- Loss of heat-insulating capability (I).

The fire endurance of civil structures is determined by testing in accordance with [1.8.1], standards for fire tests of specific structures or calculation techniques in compliance with standards or guidelines approved by or agreed with the central state fire supervisory authority.

The fire propagation limit (M) denotes the capability of a structure to spread fire. Civil structures are divided into three groups by fire propagation limit:

- M0 – fire propagation limit is equal to 0 cm;
- M1 - M < 25 cm – for horizontal structures, M < 40 cm – for vertical structures;
- M2 - M > 25 cm – for horizontal structures, M > 40 cm – for vertical structures.

By fire propagation limit, fire barriers shall correspond to group M0.

Openings in fire barriers will be equipped with fire hatches, valves and doors with EI fire endurance not less than 90 minutes.

Fire hatches, valves and fire doors will be installed.

Technical measures will be envisioned to prevent the spread of fire and combustion products at ChNPP Unit 3 and the Shelter, ensure tightness and fire endurance REI of the division wall not less than 90 minutes. This requirement will be implemented only in the scope of the NSC CS-1 design in places of structural interfaces, if necessary.

All air ducts of the heating, ventilation and air conditioning (HVAC) system, as well as components passing through the fire barriers, will be provided with automated fire locking devices (fire-resistant valves) in compliance with fire protection standards. In the event of a fire in any closed room of a contaminated or potentially-contaminated area provided with a ventilation system, the fire detection and alarm system will transfer an alarm signal to the HVAC control system to terminate air supply and close smoke and fire dampers in the contaminated area after personnel evacuation from the room in question. Smoke will be exhausted by manual control from the ventilation system control room after:

- The fire has been extinguished by the fire system or;
- The fire has ceased.

The necessary number of fire doors and fire valves with respect of relevant fire endurance will be selected depending on the purpose, structural arrangement, design and process features of the rooms to be protected, as well as the properties of materials and substances located in them.

2.11.2.1.2 General Technical Requirements for Separation into Fire Compartments and Fire Sections

Fire Compartment is a portion of building or premises space separated by fire barriers.

Fire section is a portion of fire compartment separated from other parts of fire compartment by filler structures with installed fire-resistance and flame spread.

At design of the NSC CS-1 buildings, it shall be necessary to define the parts that will serve as fire breaking sections. The necessity of installation of such fire breaking sections is defined by relative regulatory documentation (NAPB B.03.002-2007 - Regulation for Explosion-Fire and Fire Hazard Classification of Premises, Buildings and Outdoor Plants).

The classification of buildings into Fire Compartments and Fire Sections is to limit fire spreading inside the buildings and to limit fire spreading between buildings (DBN V.1.1-7-2002 - Fire Safety of the Construction Objects - Chapters 3 and 4).

2.11.2.1.3 General Technical Requirements for Evacuation Routes and Exits

Evacuation routes and exits are intended for the safe evacuation of personnel in the event of a fire.

The evacuation routes and exits must:

- Provide for timely and free evacuation of people in the event of a fire;
- Protect people in the evacuation protection from dangerous fire factors.

In the event of a fire, personnel will be evacuated on evacuation routes through evacuation exits.

Evacuation exits are those that lead out of the following:

- Rooms of the first floor: leading immediately outside or through a corridor, lobby, staircase;
- Rooms of any ground floor, excepting the first one: through a corridor (entrance hall, lobby) to a staircase or type C3 stairs in accordance with [1.3.18]; immediately to a staircase or C3 stairs in accordance with [1.3.18];
- Rooms leading to an adjacent room on the same floor, which is provided with exits as described in the previous bullets, excluding the cases identified in normative documents;
- Rooms of the base, basement, underground floor – leading immediately outside, through a staircase or a corridor leading to a staircase with an exit outside or isolated from the above floors.

The evacuation routes will not include sections passing:

- Through elevator halls and elevator lobbies (if no fire doors are present in the elevator enclosures);
- Through rooms whose exits are to be closed in compliance with operating requirements;
- By transit through staircases when the stair landing is part of a corridor;
- On the building roof, excluding roofs in operation or a specially-equipped section of the roof.

The evacuation routes and exits will comply with [1.3.14, 1.3.18, 1.3.17]. Basic requirements for the evacuation routes and exits are stated below.

The evacuation routes and exits are provided with a set of structural arrangement, design and engineering features with respect to the purpose, explosion and fire categories, fire endurance and height of the building and the number of people evacuated.

The parts of the building separated by fire walls of type 1 (fire chambers) will be provided with independent evacuation routes.

The exits that do not comply with regulatory requirements for fire safety will not be considered in the calculation of evacuation routes.

The determination of evacuation routes will take into account the personnel existing routes identified on the basis of occupational and radiation safety considerations.

The evacuation exits and evacuation routes will have identifications with use of fire safety signs in accordance with [2.4.4].

The design and layout of evacuation lighting will comply with the requirements of [2.2.46, 1.3.23].

Emergency exits will be distributed; their width and height shall comply with regulatory requirements. It should be noted that emergency exits are to be equipped, in particular, on the north and south of the NSC CS-1.

The corridors and staircases for evacuation and access to fire extinguishing will not have dead ends and will have fireproof baffles and injectors. They will be designed so as to minimize the infiltration in fire.

The NSC CS-1 rooms where personnel may be present and access and exit routes will be provided with lighting for emergency evacuation. Stationary, permanently-illuminated signs on evacuation exits and routes will be envisioned as well. These signs will be energized from an independent source of 220V and will automatically switch to built-in accumulators in AC interruption.

Emergency lighting will be provided for safe turn-off of running mechanisms and processes in the event of AC interruption. The design and layout of emergency lighting shall comply with the requirements of [2.2.46, 1.3.23] and other applicable regulations.

The emergency evacuation routes shall provide for free movement and ensure protection from fire hazards.

2.11.2.2 General Technical Requirements for Automated Fire Alarm System

The purpose of the automated fire alarm system is to provide for automatic fire detection.

The automated fire alarm devices (AFA) are intended for fire detection, data processing, notification of a fire at thins CS-1 facility monitored, issue of special information and commands for the actuation of fire automatics and other technical means.

The automated fire alarm devices will comply with the requirements of [2.2.59, 1.4.78, 1.3.14]; the main of them are as follows.

Automated fire alarm devices will:

- Actuate at the initial phase of fire progression;
- Process, provide appropriate notifications of a fire;
- Issue control commands to actuators;
- Ensure the required reliability of performance.

The AFA system shall operate automatically on a continuous and 24-hour basis over the entire operating period. Automated standby mode is the AFA basic performance mode. If a signal is issued from an automatic fire detector resulting from one of the fire factors (such as heat, smoke, flame), the system will transfer to the “Attention” mode when the design does not provide otherwise (with appropriate justification).

If signals come from two or more automated fire detectors resulting from the fire factors, or from manual fire detectors, the system will transfers into the “Warning” mode, when the design does not provide otherwise (with appropriate justification).

In the standby mode, the AFA system will provide:

- Monitoring (primary measurement, amplification and conversion) of signals from fire detectors, analysis of the environment in protected rooms and explosion and fire hazardous zones of structures;
- Diagnosis (self-diagnosis) of central station, fire detectors and signal line;
- Notification of personnel in the event of off-normal operation (preventive alarm “Malfunction”);
- Collection and primary processing of information;
- Display, record and filing of data.

In the “Warning” mode, the AFA system will:

- Notify personnel in the event of off-normal operation (emergency alarm “Fire”);
- Generate a sequence of commands for protective actions for an initiating event (fire);
- Issue input command impulses to actuators of fire protection devices and engineering equipment of the building;
- Prohibit or exclude actions on actuators that can be initiated by operating personnel if they do not comply with commands of the control system.

In the standby and warning modes, the AFA system will display, collect and record data on off-normal operation and explain the type of malfunction (break, short circuit, off-standard operation of fire detectors, loss of power supply, malfunction in software and other malfunctions), warning mode events (such as signals “attention”, “fire”), commands of protective actions, prohibition or disconnection entered by operating personnel.

If the main requirements of this section are met by the AFA system, a fire can be detected at an early stage and, thus, necessary measures can be taken on a timely basis to prevent the damage of structures and basic equipment as may be caused by fire factors.

The need to equip rooms with automated fire alarm devices will be determined in accordance with [2.2.31, 1.3.17].

AFA devices shall be designed in compliance with the requirements of [1.4.10, 1.3.14].

AFA devices, types and number of automated fire detectors, equipment and devices will be selected depending on the purpose, structural arrangement, design and technological features of rooms, as well as properties of substances and materials located in them, and technical documentation of the AFA system manufacturer.

Automated fire alarm devices will be capable of:

- Analyzing the conditions in monitored rooms;
- Assessing the level of hazard and providing an adequate response to it;
- Diagnosing its state, informing of malfunctions, potential or actual damage, disconnecting damaged sections of lines with subsequent normal performance;
- Keeping a permanent link with the central station and transferring data, in particular, on changes in monitored areas.

The devices will remain operable in conditions of radiation. Airflows, electromagnetic radiation or temperature fluctuations in monitored rooms will not affect the performance of the systems.

AFA devices will provide for prescribed actions for controlling the automatic systems (actuation of fire-fighting facilities, smoke removal, disconnection of ventilation systems, actuation of notification systems, audible and visible indicators, control of door position and other prescribed actions).

The AFA operability will be checked in their commissioning and then periodically over their lifetime. They will be certified in the UkrSEPRO system.

Manual fire detectors will be installed at entries into fire-hazardous rooms, in corridors and staircases to provide for manual actuation of fire automatic systems.

A notification of a fire will be replicated on the communication point located in the ChNPP fire unit.

2.11.2.3 General Technical Requirements for Automated Fire Fighting Devices

The purpose of automated fire-fighting devices is to provide automatic fire extinguishing through supplying fire-extinguishing substance.

Automated fire-fighting devices will:

- Actuate at the initial phase of fire;
- Extinguish or confine a fire within a period of time needed for actuation of relevant forces and means;
- Ensure supply of fire-extinguishing substance at a relevant rate and (or) in necessary concentration;
- Ensure necessary reliability of performance.

The need for equipping the rooms with automated fire-fighting devices (AFF) will be determined in compliance with [2.2.31, 1.3.17].

In compliance with regulatory requirements, NSC fire-hazardous rooms and rooms with fire loads more than 400 MJ/m^2 will be equipped with automated fire-fighting devices.

Automated fire-fighting devices (AFF) will be provided in:

- Fire- and explosion-hazardous rooms;
- Rooms adjacent to the division wall;
- Rooms containing cable routes;
- Rooms and equipment of exhaust ventilation systems;
- Rooms housing electronic equipment;
- Rooms housing 0.4 and 6 kV switchgears.

AFA, AFF systems will be provided in:

- Basement rooms of category C, given the area equal to 700 m^2 and more - AFF, less - AFA;
- Rooms with suspended ceiling, given service lines above the suspended ceiling (air ducts, pipes, cables) with insulation of hardly-flammable or flammable materials regardless of the area, with the number of cables between 5-12 - AFA, more than 12 - AFF;
- Rooms with computer systems – AFF – regardless of the area;
- Archive rooms - AFA – regardless of the area;

- Administrative and utility services (all rooms – AFA, excepting rooms with wet processes);
- Warehouses of combustible materials, 1000 m^2 and more - AFF, less – AFA;
- Warehouses of non-flammable materials in a flammable package, 700 m^2 and more – AFF, less – AFA;
- Mechanical, repair, assembly shops, 750 m^2 and more - AFF, less - AFA;
- Newly-created rooms, which are adjacent to the Shelter (if AFF not installed) – AFA;
- Air locks – AFA.

The requirements for AFF components and the entire systems are stated in [1.3.14, 1.3.16, 1.4.10, 2.2.50]. Requirements of technical documentation of the AFA manufacturers will be considered as well. Below are basic technical requirements for AFF devices.

The type of AFF, type of fire-extinguishing substance, extinguishing method, equipment and devices will be selected depending on the purpose, structural arrangement, design and technological features of rooms, as well as properties of substance and materials located in them.

Fire-extinguishing substances shall be safe for personnel and shall not increase the level of FCM criticality if penetrate in the OS.

In determining the types and components of the systems, the following will be considered in particular:

- Properties of combustible substances and materials in contact with fire-extinguishing substances;
- Distribution of fire loads within the area of rooms;
- Fire hazard of rooms;
- A class of probable fire;
- Effectiveness of extinguishing methods for specific cases (extinguishing of the entire area, local – separate sections, equipment or volume); potential fire scenarios;
- Potential access to rooms for manual fire-extinguishing;
- Environmental conditions (humidity, dustiness, radiation, potential mechanical damage);
- Admitted duration of regular maintenance of fire-fighting devices.

Automatic and remote control of the AFA system will be envisioned in a continuously-attended room.

The operability of fire-fighting devices and means will be checked in their commissioning and then periodically over their lifetime. They will be certified in the UkrSEPRO system.

2.11.2.4 General Technical Requirements to Fire Alarm Announcement and Evacuation Management System

The purpose of a fire alarm announcement and evacuation management system notification and evacuation system is to assure safe evacuation of the personnel in case of fire.

Personnel shall be announced of the fire in one of the following ways:

- Produce audible and (or) visual signals to all the rooms of the building of permanent and temporary staying of the personnel;

- Broadcast of evacuation necessity verbal messages, evacuation pathways and other actions.

Evacuation management shall be performed with the following:

- Switch-on evacuation lighting and evacuation direction lights;
- Broadcast of the special developed texts on the fire alarm (announcement) system, aimed at prevention of panics and other events complicating evacuation process (accumulation of people in passageways etc.);
- Broadcast of the texts containing information of the necessary traffic route.

The requirements to the elements of the Automatic Fire Warning System and Evacuation (AFWS&E) and to the entire system are presented by the documents [1.3.18, 1.3.16, 1.3.14], at that, it is also necessary to take into account the concerned technical means manufacturer's technical documents requirements. Below provided are basic technical requirements to the AFWS&E facilities.

The announcers' number, location, and capacity should ensure necessary audibility in all the permanent or temporary attendance places.

The audio fire announcer should be connected to the network without plug-type devices and should not have volume controls.

Fire announcement signals should distinguish from other purpose signals.

The communications of the Fire Announcement System may be designed as integrated with the object broadcasting system.

It is advisable to accept the requirements to power supply, earth, grounding, choice and lining of the announcement networks by analogy with the requirements to design of automated fire alarm facilities by [1.4.10].

Control of the Announcement System should be envisaged from the7 room of the fire post, dispatcher room. The requirements to such a room shall be accepted by analogy with the requirements to the rooms of the personnel on duty by [1.4.10].

In accordance with the requirements [1.3.18] (in the portion of industrial building), as well as taking into account peculiarities of the object under consideration, NSC will be equipped with the AFWS&E of type 2 by [1.3.18] with additional use of verbal announcer by [1.3.16].

The AFWS&E of the above type should have the following features:

- Ways of announcement: audio (ring, tone signal, etc.), verbal (record and transmission of special texts), light ("Exit" light signs);
- Priority of announcement – simultaneously for all;
- Full automation of the AFWS&E control is not required.

All the premises possibly attended by people will be equipped with the Fire Announcement System. Remote actuation of the Fire Announcement System is admitted. Audibility of the prearranged audio signal should be ensured in all the premises of the object.

The Fire Announcement System should envisage alternation of an audio signal and verbal announcement by speakerphone, equipment of which should be installed in all the attended premises taking into account bi-directional (duplex) communication along the evacuation routs.

The announcement systems will be made taking into account the possibility of direct transmission from the Unit Shift Supervisor work place of verbal announcement and management commands through the microphone for urgent reaction during change of

conditions or breach of normal conditions of evacuation, as well as possibility of talks with the personnel being in the attended premises.

The fire announcement systems should meet the requirements of existing state, departmental, as well as special developed normative documents.

2.11.2.5 General Technical Requirements for Smoke Protection and Ventilation Systems

The purpose of the smoke protection system is to provide safe evacuation of people at the initial phase of a fire through preventing the impact of smoke, increased temperature and toxic combustion products on people.

The smoke protection system will:

- Remove smoke from rooms, evacuation corridors and halls (but not in the entire arch volume);
- Create overpressure of clean air along the evacuation pathways (in lobbies-locks etc.);
- Reduce smoke generation and air temperature along evacuation pathways because of smoke suppression.
- Air supply to fireproof locks, staircases of N2, N4 types by [1.3.18] and other protected spaces (in accordance with the normative requirements) in order to create overpressure (positive pressure) and prevent effect of the fire hazardous risks on people.

If corridors and staircase are used as emergency exits, they should be under overpressure comparing to the neighbourhood premises and air flow rate through the door openings shall meet the level required by the normative documents to ensure smoke and contaminative substances removal in case of fire. Backup outside air supply devices powered by two different sources should supply outside air. If pressure level decreases backup system will start automatically.

For the purposes of smoke protection smoke suppression facilities might be envisaged consisting of smoke suppression units, devices and systems ensuring their functioning.

Requirements to choice of equipment, design of smoke protection ventilation systems in the NSC premises should be determined in accordance with the documents [1.53, 1.3.14] and accounting technical documents of the smoke protection means manufacturers.

Requirements to ventilation depend on fire risk category of the buildings, premises, areas.

2.11.2.6 General Technical Requirements for Fire Water Supply

The purpose of the fire water supply system is to provide fire extinguishing with water as fire-extinguishing medium.

The fire water supply system should:

- Ensure water intake for fire extinguishing;
- Transport water for fire extinguishing;
- Store water for fire-extinguishing in cases identified in regulations;
- Provide for water use as fire-extinguishing medium.

The fire water supply system will consist of two subsystems:

- Fire water supply for external fire extinguishing;
- Fire water supply for internal fire extinguishing.

A separate high-pressure fire pipeline will be envisioned for external and internal fire extinguishing of buildings and structures, for operation of cooling facilities in a fire on civil structures and stationary fire-extinguishing facilities in compliance with [1.5.1].

The network of fire pipelines will be looped and divided by valves into repair sections, each will supply water to no more than five fire hydrants for external fire pipeline and 12 fire valves for systems of the internal fire pipeline.

2.11.2.6.1 External fire water supply

The design and layout of fire water supply for external fire fighting will comply with the requirements of [1.5.1].

2.11.2.6.2 External networks and structures

The NSC will be provided with the water amount necessary for fire-fighting purposes (as required by construction standards and other regulatory documents). In determining the head, flow rates and volumes of water for fire extinguishing, one will be guided by [1.5.1, 1.5.2]. If water head is insufficient, pumps increasing pressure in the network will be installed.

Tanks or reservoirs for fire water supply are needed only if water supply or water head cannot be provided in the ChNPP site. The tanks used for fire water supply, if their need is justified, will comply with [1.5.2], and also equipped taking into account prevention of possible radioactive contamination of water.

If tanks or reservoirs are needed, the restoration of fire water reserve will not take more than 24 hours.

Fire hydrants will remain operable and be located so that provide for convenient water intake by fire engines.

Signs will be placed near fire hydrants and reservoirs.

In addition to the main fire pumps, pumping stations will be provided with pumps for maintaining constant pressure in the network of fire water piping and providing the operation of internal fire faucets with the greatest flow rate. The number of redundant pumps in this group will be determined in accordance with [1.5.2].

To maintain constant pressure in the network of fire water pipeline, pumps of the industrial water supply system may be used provided that the water quality, flow rate and water head for internal fire faucets and system reliability are not worse than those of the fire water pipeline. Connection of the fire pipeline to the network of industrial water supply will be provided no less than in two points including the installation of shutoff and check valves.

The quality of ChNPP water in the fire pipeline system shall prevent potential contamination of sprinklers. For this purpose, the system will be filled with water cleaned of organic and mechanic admixtures.

A reserve of water not intended for fire purposes is not permitted to be used for common and industrial needs.

External and internal networks of fire pipeline and networks of water fire-extinguishing and cooling facilities will be made of steel tubes.

Steel valves and steel connecting components will be used in external and internal water supply networks. Valves of non-ferrous metal may be used for fire faucets in internal networks.

In other respects, the networks will comply with the requirements of [1.5.2].

2.11.2.6.3 Internal fire water pipeline

The number of inlets into the building, water flow rate for internal fire extinguishing and the number of streams from fire faucets are determined in accordance with requirements of construction standards. The design and layout of fire water supply for internal fire extinguishing will comply with СНиП 2.04.01-85.

2.11.2.6.4 Internal water pipeline and drainage of buildings.

Internal fire cocks shall be installed at easy-to-get-at places - not far from entrances, at entrance halls, corridors, passages. The place of their installation therewith shall not result in evacuation routes obstruction. A fire cock shall be completed with fire-hose having fitting diameter and nosepiece, as well as an arm to make easier turning on of a valve.

Fire cocks should be installed in embedded hinge boxes that have ventilation openings and fit for sealing and visual inspection.

A fire cock shall be installed in the way to make easy valve turning and hose attachment. An axis of fire cock nozzle outlet shall be directed to omit folding of the fire hose at its connection.

Outside the doors of the fire cock boxes the following information should be given after the “ПК” letter code: fire cock serial number, name of individual responsible, date of hoses winding and fire brigade telephone number. Exterior of a door should meet the effective standards requirements.

Fire cocks shall always be operable and available for usage.

At winter time water shall be discharged from the internal fire line installed within unheated premises. Therewith special plates should be fixed near fire cocks, informing of place of installation and procedure of corresponding valve turn on and pump start-up.

The “Sukhotrub“ (dry) fire water supply system is allowed for usage for fire fighting within premises(zones) with the understanding that water will not be brought into the premises, where it can impact the nuclear and radiation safety of the Object Shelter.

2.11.2.7 General Technical Requirements for Primary Fire Fighting Means

The purpose of primary fire fighting means is to provide personnel with manual means for fire extinguishing at the initial phase of a fire before arrival of the fire brigade.

Primary fire fighting means will:

- Ensure personnel with a reserve of fire-extinguishing means (such as fire extinguishers, boxes with sand, drums with water);
- Provide personnel with means for supply of fire extinguishing media (such as fire buckets, shovels);
- Provide personnel with fire fighting means (such as fire extinguishers, blankets of non-flammable heat-insulating cloth, felted fire cloth);
- Provide personnel with fire instruments for dismantling of civil structures (such as hitchers, crow bars, axes)

The primary fire-fighting means include fire extinguishers, internal fire faucets, fire inventory (such as boxes with sand, drums with water, fire buckets, shovels, blankets of non-flammable heat-insulating cloth, felted fire cloth) and fire tools (hitchers, crow bars, axes).

Technical requirements on the primary fire fighting means will be identified with respect of [1.3.14, 1.3.17]. General technical requirements are stated below.

If several different fire zones are located in one room, which are not separated by fire walls, all these rooms will be provided with fire extinguishers, fire inventory and other types of fire fighting means in accordance with standards for the most hazardous processes.

Fire shields (stands) will be placed, in particular, in the auxiliary building – one shield (stand) per 5000 m^2. The set of fire-fighting means on the shield will include:

- Fire extinguishers – 3 items;
- Box with sand – 1 item;
- Blanket of non-flammable heat-insulating cloth 2x2 m;
- Hitchers – 3 items;
- Shovels – 2 items;
- Crow bars – 2 items;
- Axes – 2 items.

One fire extinguisher (but not less than one per floor or layer) will be provided for each 20 metres of civil structures and constructions (each floor or layer of scaffolding). One fire extinguisher and box with sand will be envisioned for each 200 m^2 of the covering with combustible roof material. 5-l powder fire extinguishers will be used in the above places.

The type, the number of fire extinguishers will be determined in compliance with regulatory requirements depending on fire-extinguishing capability, explosion and fire category of the room and on the maximum area and fire class of combustible substances and materials [2.4.2].

The selection of a functional type of fire extinguishers (portable or transportable) depends on the dimensions of the territory to be protected. If dimensions of the area exceed the limit, portable fire extinguishers will be selected.

Process facilities will be provided with fire extinguishers in compliance with the requirements of technical specifications (certificates) for this equipment or regulatory requirements.

The distance from a potential fire place to the location of fire extinguishers will not exceed 30 metres for rooms of categories A, B, C (1-4) (flammable gases and liquids), 40 metres for rooms of categories C, D (1-4); 50 metres for rooms of category E (1-4).

Corridors (passages) of industrial and auxiliary rooms will be provided in fire extinguishers as follows – one fire extinguisher per 50 metres of the corridor (passage) but not less than 2 per floor.

Primary fire-fighting equipment will be provided only for CS-1 needs. The reserve for CS-2 is not envisioned since categories of potential sources are unknown.

2.11.2.8 Technical Requirements for Fire Protection Systems in General

2.11.2.8.1 Requirements to integration to the existing system of fire protection

All of the new created fire protection systems shall be integrated to the extent feasible to the existing Object Shelter and ChNPP fire safety system, providing the existing systems comply with the required engineering level. Upgrades to the Object Shelter and ChNPP fire safety systems are not part of the NSC CS-1 Scope of Work.

2.11.2.8.2 Requirements for performance of fire protection systems

To achieve the purposes and perform the functions of fire protection system the below basic requirements shall be met.

Systems of fire protection will be developed as man-machine systems working in real time mode.

The scope of the functions performed by fire protection systems shall vary in the course of their functioning depending on operating modes of the systems:

- Standby mode (or expectation mode) when signs of fire or ignition are absent from the facility;
- "Fire" mode (or "Alarm" mode) when signs of fire or ignition are available in the facility;
- The scope of functions performed by fire protection systems does not depend on the NSC operation modes.

Additional function of fire protection systems is diagnostics of firemen announcers' status, communication lines and self-diagnostics of the devices included in the systems.

Diagnosis of fire annunciators, communication lines and self-diagnosis of devices included in the system are an additional function of fire protection systems.

Functioning of fire protection systems shall be carried out under the following conditions of unfavourable environment impact:

- Increased ionizing radiation rate;
- Increased humidity.

The fire protection system shall provide for possibility of manual control mode with activating devices:

- Remote – from the rooms with personnel on duty and, if necessary, from the entrance to protected room;
- Local – from devices, installed on activating equipment of the systems.

Functioning of fire protection system shall provide for maximum availability of information of fire status of the facility for NSC operation and administrative personnel, offsite emergency responders and State Fire Subdivisions.

Systems of fire protection systems shall be designed as open systems, allowing integration with existing systems of fire safety, automatic systems and NSC control, and in future – integration with new created systems of fire safety.

2.11.2.8.3 Requirements for reliability

In general, the reliability of the fire protection will be defined as described in section 2.6.3.2 of this CDSD.

In terms of reliability, the fire protection systems are multifunctional man-machine systems to have structural, time and functional redundancy and relate to restorable systems of long-term performance in continuous mode.

The fire protection systems are intended for performance in the mode of routine operation, emergencies and accidents, ignitions and fires, excluding accidents leading to damage of system equipment.

Failure criteria of the fire protection systems are such malfunctions which can lead to:

- Partial or complete loss of control over hazardous fire factors at the facility;
- Absence of signals notifying of a fire if occurred;
- Failure to perform functions by the fire protection systems after a signal of a fire.

Reliability requirements for the fire protection systems components should include:

- Requirements for unfailing performance;
- Requirements for maintainability;
- Requirements for durability.

2.11.2.8.4 Requirements for certification of fire hardware

Any preventive equipment installed under any project in Ukraine should be certified. Fire hardware, in compliance with [1.1.10, 1.3.14], should have certificates of conformance or certificates of compliance of the system with the UkrSEPRO certification system. Organizational and legislative basis will be used to confirm the compliance of products, as identified by the Cabinet of Ministers.

Certificates of conformance or certificate of compliance of fire equipment may be issued to the manufacturer (supplier) of products in compliance with obligatory and voluntary certification procedure according to current regulations on fire safety [2.2.34].

2.11.2.9 Calculation of Impact from Maximum Probable Fire on Arch Structure

In the detailed design phase taking into account the ultimate design solutions for the NSC, NOVARKA will perform verification calculations in compliance with [3.22], and make appropriate engineering decisions based on the calculations in compliance with the basic design criterion "Ensure the integrity of the NSC enclosure in the maximum potential fire – ignition of the turbine hall roof and deaerator stack" [3.22]. In addition, in letter No. 21/3/4058 of 17 December 2004 it is stated that the arch structure will be modelized for fire resistance prior to the NSC installation. Based on the calculation, fire protection measures will be identified, in particular, cooling of NSC structures and provision of fire protection coating.

In accordance with item 2.19 from [1.3.18], in implementation of contraction of buildings structural systems that may not be explicitely referred to a particular fire resistance category (as in this case), decision on their fire resistance rate should be taken based on results of full-scale fire tests of fragments of such buildings applying methods approved or concurred by the Central Body of State Fire Inspection – State Department of Fire Stafety under the Ministry of Emergencies of Ukraine. SDFS MEU also deals with concurrence of design decisions governed by no rules or norms (section 1, 2 [2.2.33]), - in the current case, these are design fire resistance rates for arch structural elements as well as design justification of the smoke protection system. SDFS MEU experts council, concurring the design decisions made, shall be involving specialists representing research institutions for fire safety and other specialists assigned by SDFS management (item 3.2[2.2.33]).

In any case, either testing or mathematical calculation of structures fire resistance is carried out., the associated methodology of testing (calculation)has to be developed and be concurred by SDFS MEU.

2.11.2.10 Internal Fire

- NOVARKA shall provide thermal-dynamic analysis of the penalizing fire in NSC on the basis of 3D model taking into account design decisions of the Arch elements, including structural elements of sub-crane ways and main cranes, and ensure stability of all structures in case of penalizing fire.
- The Analysis shall also clarify the smoke generation dynamic inside the Arch and to propose organizational measures or/and to develop design solutions related to the implementation of smoke removal system.

- NOVARKA shall assess the necessity for and material characteristics of the internal ceiling, coating on the main structure and technical measures to mitigate the effect of the fire. Necessary testing shall be performed and included in the Factory Acceptance Tests and Material Testing Plans and procedures.
- The Analysis shall be based on the following:

1. Fire load:

– The worst conceivable fire is on the turbine hall roof and de-aerator stack roof fire whose characteristics are the following:

– Fire loading on the turbine hall roof and de-aerator stack building roof consists of 4 layers of roofing material of grade PM-350 of 0,5 mm thick on hot bitumen mastic of grade МБК-1-55 with the common thickness of 15 mm. The following table shows in more details the characteristics

N	VALUE TITLE	VALUE	UNIT
1	Fire loading on the turbine hall roof and de-aerator building roof	20,8	Kg/m^2
2	Combustion Heat of fire load	29,485	MJ/kg
3	The maximal mass speed of burning out of fire loading	0,00258	kg/(m^2/s)
4	The maximal temperature of flame	1200	°C
5	Amount of air necessary for burning of 1 kg of fire load	9,45	m^3/kg
6	Reference temperature in NSC space and structures till the moment of fire	20,0	°C
7	Temperature outside NSC	20,0	°C
8	Density of combustion gases products	0,1	kg/m^3

2. Design Criteria:

The fire resistance to be considered for the bearing and framework structures of the NSC enclosure is 30 minutes.

The NSC shall be considered as a facility superimposed with the roof, therefore, the fire resistance rates for the NSC structures are as follows:

– For bearing arch elements: truss framework –a minimum fire resistance limit is R 30 minutes, a maximum fire extension rate is – M0;

– For framework structures: decking and girders, - a minimum fire resistance limit is RE 30 minutes, a maximum fire extension rate is –M0.

2.11.3 PROCESS AND OPERATION SUPPORT SYSTEMS

All technical and process systems of the NSC CS-1 will be operated for a long period of time (up to 100 years). Therefore NOVARKA will provide plans for their maintenance, recovery, repair, replacement over the NSC service life.

2.11.3.1 Indoor Transportation System

The design of the indoor transportation system will consider the following functions:

- Transport mechanisms and structures to and from areas of dismantling/reinforcement of unstable structures, collection of radwaste;
- Transport radwaste from the collection zones to the areas/units for radwaste management;
- Transport radwaste inside NSC between different areas of radwaste management to the area of preparation for radwaste transportation;
- Transport empty containers, materials and mechanisms required for normal operation of the NSC CS-1, limited inside NSC only. Interface between CS-1 and ChNPP is the truck loading Airlock NW, possible the SW large Airlock.
- Transportation of personnel inside the NSC.

For selection of transport corridors, evacuation routes the intake of minimal doses, minimal risk from equipment failure in transportation, minimal probability of safe confinement components' breakage will be considered.

The NSC CS-1 Design will consider existing dismantling techniques and technical solutions, as suggested in documents [2.6.10, 2.6.11, 2.6.12, 2.6.13], (refer to CDSD sections 3.7):

- Fragmentation of large concrete structures;
- Fragmentation of main beams.

NOVARKA will design the following:

- Ensure a system of basic cranes, including control and monitoring systems, power supply system, maintenance garages, storage rooms for crane trolleys, fastenings for hinged equipment etc., special trolley with telescopic mast;
- Ensure equipment for transportation and loading of operational radwaste of NSC CS-1;
- Ensure equipment for delivery of cargoes and personnel to workplaces for NSC CS-1.

Equipment for transport of personnel involved in dismantling, as well as materials, equipment and waste generated or used in dismantling measures are not included in the scope of the Contractor services. However, the Contractor will present an internal transportation system in compliance with the NSC CS-1 needs, excluding the unfavourable impact on NSC CS-2 (according to available data to contractor during its design period).

2.11.3.2 Main Cranes

The main cranes are part of the main NSC facility equipment and are classified within the indoor transportation system described in the above section. They will be used to transfer tools and grippers to deconstruction areas inside the OS and will transfer the removed pieces of unstable structures down to the lay down area. The functions of the main cranes are provided in details in section 1.4 of the CDSD.

The main cranes are the only mechanical CS-1 system which will mechanically interact with the Shelter and the unstable structures and are the only CS-1 system which might require personnel emergency interventions over the opened OS. Therefore, their failures might induce significant dose burdens because of external and internal exposure.

With this in consideration, the main cranes will then be subject to detailed reliability analysis in order to ensure that the probability and extent of exposure of the personnel, following their failure, complies with the requirements defined in section 2.6.3.

The maximum allowable probability of load drops will be determined on the basis of the potential consequences, considering the provisions made in the NSC Design, to limit personnel and public exposure to radiation. This probability shall be reduced down to reasonably

achievable low level. Drop of massive elements of crane equipment and loads to the space underneath may lead to significant release of radioactive dust into the main NSC volume and violation of nuclear safety criteria. Probability of such event shall be minimised, at this, in this ratio main crane elements shall be considered as IS-1.In particular, in case of crane equipment drop and/or loads outside the arch space, the effective dose received does not exceed 100 mSv and the dose equivalent does not exceed 150 mSv, the maximum probability of load drop will be low enough for the summary probability of personnel potential exposure, with various initial events, not to exceed 10^{-2}/y.

This maximum allowable probability of load drops will include:

- The probability of failure of the load slinging system (bad attachment of grippers by personnel and bad gripping of loads, failure of the system itself etc...). This value will be defined as a Design criterion for the CS-2 contractor;
- The probability of failure of the loads themselves (weaknesses at the gripping location…). This value will be estimated on the basis of knowledge of the structural status of the unstable structures;
- The probability of failures resulting in drops of crane component or exceed of loads on the back-up system.

Another main ruling criterion for the main cranes is the probability of getting stuck above the shelter. With an approach similar to above, this will define:

- The reliability requirements providing for minimisation of load drop and or crane components into the space under the SO roof for all components of the cranes;
- The needs for technical means to retrieve the crane back to its park position;
- Additional protection provisions to allow safe access of personnel above the cranes in case stuck items cannot be remotely unlocked.

2.11.3.3 Heating, Ventilation and Air Conditioning System (HVAC)

The HVAC system will:

- Confine contamination by assuring that airflow is always from areas of lower potential for contamination towards areas of higher potential for contamination;
- Maintain operated release into the environment and assure filtration within the parameters prescribed by corresponding regulations
- Provide parameters of industrial environment (temperature, humidity, air velocity and cleanliness) for personnel comfort and safety, and for proper operation of equipment in compliance with [1.2.3] requirements (taking into account the use of individual protection means and individual respiratory protection means);
- Prevent the spread of smoke and combustion products in the event of a fire;
- Prevent generation of flammable and explosive vapours, gases and dust in excess of established values.

The ventilation system is needed to:

- Assure that airflow is always from areas of lower potential for contamination towards areas of higher potential for contamination;
- Ensure compliance of the airborne level with the document “Design Permissible Levels for NSC” [1.2.6];

- Ensure that releases are below the limits established in the "Design Permissible Levels for NSC" [1.2.6] and "Technical Solution for Determining Quotas for Limits of Low Release from NSC" [1.12.4],
- Ensure minimally required rates of air flows to prevent dust elevation and transfer;
- Ensure the controllability of environment (temperature, humidity and cleanliness) for personnel comfort and safety, and for the proper operation of equipment in closed rooms of the auxiliary building and arch of the NSC;
- Prevent generation of flammable and explosive vapours, gases and dust in excess of established values;
- Prevent the spread of smoke and combustion products in the event of a fire, and remove smoke if necessary [1.12.15];
- Ensure compliance of the humidity level with design limits identified for the lifetime of the main arch structures (the Contractor shall establish such limits with respect to the requirement to minimize NSC maintenance);
- Prevent condensation (generation of liquid radwaste) inside the NSC;
- Maintain optimal conditions for operation of process equipment.

The main requirement for NSC temperature and humidity is to prevent humidity condensation inside the NSC.

Basic criteria of temperature and humidity inside the NSC will be as follows:

- Supply of atmospheric air to the ring gap of the arch, the supplied air is preliminary heated;
- Limited supply of atmospheric air to the NSC air space.

The supply mode and parameters of the air flow will:

- Prevent condensation of atmospheric moisture in the NSC;
- Prevent condensation of atmospheric moisture on the external surface of the existing Shelter to minimize the generation of liquid radwaste;
- Ensure minimally required rates of supplied air flows to prevent the elevation and transfer radioactive dust, in particular, outside the working area.

The design phase will deal with a detailed analysis of the NSC temperature and humidity taking into account thermo-physical characteristics of the arch thermal insulation, all thermo-physical parameters of the Shelter and technological processes involving the injection of pre-heated water solutions. Based on the results, the most optimal solutions will be proposed to satisfy the above conditions.

The NSC will include local systems that ensure maintaining specific temperature and humidity in continuous process and/or attendance rooms, as well as at work performance sites. Note: nevertheless, the NSC CS-2 Contractor will be responsible for providing equipment to ensure such conditions on opened areas under the NSC arch where dismantled structures are dealt with.

No specific limits for humidity inside the entire NSC will be established. Thus, taking into account negative consequences of moisture condensation, in accordance with the NSC FS (CD), for the exception of fallout of atmospheric moisture under the arch it will be envisaged to maintain specific temperature and humidity in the NSC ring gap between external and internal envelopes of the arch and unheated air inside the NSC.

The NSC CS-1 design will include additional studies of the acceptance temperature and humidity inside the NSC and justification for the proposed solution (considering overall and local

ventilation systems) based on the radiation safety analyses for the accepted leak-tightness criteria.

The NSC CS-1 design will include measures to prevent humidity condensation inside the NSC.

If based on the thermal and humidity analysis performed at the design stage, the temperature and humidity control will no fully eliminate moisture condensation inside the entire NSC including external surfaces of the existing OS; the design will propose the appropriate local compensating solutions. In particular, a condensation collection and removal system will be designed if necessary.

Some NSC buildings and rooms will be equipped with local systems which can be integrated into the common system.

The feasibility of this integration will be specified in the design based on the cost/benefit analysis.

The design of these systems, the following will be taken into account:

- In all areas, which are continuously or intermittently occupied by personnel, specific temperatures will be maintained. Specific temperatures for each area will be established based on the activities at this site taking into account types of applicable PPE and RIPM (if necessary);
- Air filtration systems enabling to remove increased dust level and radioactive contamination from the personnel attended areas shall be installed, if necessary (See note below);
- Provision of mechanization and automation of maintenance, repair and replace of filtration equipment and if required, distant performance of this work;
- Prevent movement of air from contaminated areas to relatively cleaner areas;
- Provide air locks between different contamination controlled zones (Zone 1 / Zone 2 and Zone 2 / Zone 3);
- Maintain temperature, humidity and cleanliness in the central control panel (CCP) and rooms housing automatic control equipment;
- Provide local exhaust systems in areas where dust or smoke generation is expected (see note below);
- Provide local radiant heating as required for specific operations related to CS-1 maintenance;
- Prevent generation of flammable and explosive vapours, gases and dust mixtures in excess of established values;
- Ensure smoke exhaust from occupied areas and smoke protection of the evacuation routes;
- Consider zoning of areas depending on the type of activity and expected contamination during work;
- Provide automated monitoring and control of special ventilation, filtration and air conditioning from the CCP and locally (if necessary).
- Ventilation systems operating in premise for I Class work shall be have reserve units (100%).
- Air consumption at reserve units upon appearance of malfunction of equipment of exhaust system of ventilation shall be no less than 50 % of design value.
- Filtration shall have systems of automatic alarm and control of their work efficiency, relative humidity and air velocity.

* Note: equipment for managing the releases from equipment of the NSC CS-2 Contractor (e.g., local filters or exhaust ventilation ducts) will be provided by the NSC CS-1 Contractor.

The heating medium for the heating system will be supplied from the existing ChNPP heat supply system. The boundary and connection conditions will be agreed with the Client.

The design of the heat supply system will consider the following system functions:

- Ensure normal conditions for personnel work;
- Maintain temperature and humidity in the NSC rooms in accordance with process and design parameters;
- Supply heat to the plenum chambers for preparation of hot water for process needs and hot water supply.

At subsequent design phases, these decisions will be specified in compliance with Ukrainian regulatory requirements.

NOVARKA will provide a hot-water heating system for NSC CS-1 and take into account needs of NSC CS-2 according to [3.28]. The following will be envisaged:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;
- Hot-water heating for NSC CS-1;
- Connections to the hot-water heating system for NSC CS-2;
- Integration with existing ChNPP systems.

Water for heating will be supplied from the ChNPP site heating network. Water can be directed to HVAC equipment or for heating of the secondary closed circuit. The design will provide for measures to prevent freezing of teat exchangers subjected to cold air. It is recommended to consider the installation of electrically-driven valves and manipulators for flow control. If pneumatic valves and manipulators are selected, compressed air supply will be envisioned.

General industrial requirements for HVAC are determined in [1.5.3, 1.7.33].

Document [1.2.3] identifies provisions on “ventilation, dust and gas treatment, heating” to be satisfied in the NSC design. Document [2.1.1] sets in detail some provisions of [1.2.3]. These regulatory requirements are provided in A.2.5 and A.2.6 to this Chapter.

According to Section 2.1 [1.12.8], if NOVARKA has some deviations from these documents, appropriate justification and agreement with the regulatory authorities will be required.

According to [1.12.11], NOVARKA will provide ventilation, gas treatment and air conditioning systems for NSC CS-1 and address NSC CS-2 needs. This will include:

- An extract and input system for the arch to prevent condensation and, if necessary, to provide appropriate temperature and humidity, involving radiological monitoring of releases;
- A ventilation system to prevent contamination spread when the north gate and south air lock are opened;
- Extract and Supply ventilation system for the annular space with 100 % recycling Air Handling Units (AHUs), heating and cooling for supplied air (AHUs with control of temperature, hygrometry and overpressure in the annular space);
- A ventilation system for the auxiliary (process) building, including extract and input ventilation for rooms of zones 1 and 2 (such as air locks, maintenance, decontamination and repair shops); central control room; office rooms; restrooms; other rooms and sections (considering needs of both commissioning stages);

- Upgrading of the existing ventilation system of deaerator rooms as regards air intake and release to prevent the combination of atmosphere and ventilation of the NSC arch space;
- A ventilation system for NSC internal structures for CS-1, reservation of areas and connection points for NSC CS-2;
- A ventilation system for other auxiliary buildings and structures for NSC CS-1, reservation of areas and connection points for NSC CS-2;
- Gas treatment in NSC CS-1 ventilation systems in compliance with sanitary regulations and reservation of areas and connection points for NSC CS-2;
- Air conditioning at NSC CS-1 workplaces in compliance with sanitary regulations and reservation of areas and connection points for NSC CS-2.

In addition to the above, according to [1.2.3] (Sections 12.2.23, 12.2.24), a compressed air supply system will be envisaged for operations of class I in rooms of zones 1 and 2. The supplied air will have the radionuclide concentration not more than permissible values for air supply to hose individual protection means (pressure suites, pressure helmets, hose gas masks). The system will have air distributors for simultaneous connection of not less than 2 hose individual protection means. Deviation from this requirement will be justified on the cost/benefit basis. NOVARKA will consider but not install equipment of this system. The NSC CS-1 design will contain some restrictions (e.g., physical space and electric power) to allow the NSC CS-2 Contractor to install this equipment.

Main characteristics of ventilation systems will be studied during the Design Stage.

2.11.3.4 RAW Management System

Management system of solid and liquid RAW, generated during operation of structure, systems and equipment of NSC will be developed in the Design of NSC CS-1.

Design of NSC CS-1 liquid and solid RAW management will include collection, fragmentation, sorting and conditioning of operation RAW meant for transportation from NSC.

To meet the requirements of NSC-DC&R, addressed to the operational SRAW of NSC, NOVARKA will provide with the following:

- Equipment for collection, primary sorting, containerization, loading and transportation of the LL and IL operational (primary and secondary) SRAW to the other facilities of ChNPP;
- Equipment for collection, containerization and transportation of HL operational RAW in a case of their detection;
- Integration with ChNPP systems.

The RAW management Design solutions addressed to RAW management will consider as much as possible:

- Integrated Program for RAW Management During ChNPP Decommissioning and Shelter Conversion [3.10];
- The documents developed within SIP;
- The existing ChNPP practice for RAW management (This practice is extensively addressed in the RAW management procedures applicable at the OS and ChNPP) [3.10].

Design of NSC CS-1 will assume the space, required for management works with the additional wastes that may be generated, during the operational life-time (maintenance) of NSC and dismantlement/reinforcement of the OS unstable structures.

2.11.3.5 Electrical Power Supply System

2.11.3.5.1 General Requirements

The electrical power system will consist of two subsystems:

- Electrical power supply system for non-safety-related systems, facilities and equipment for normal operation;
- Electrical power supply system for safety-important equipment for normal operation.

The NSC CS-1 design will identify all electrical loads with respect to their categories, as defined in [1.3.23], Sections 1.2.17 and 1.2.18, including those NSC loads identified as category I and special group loads:

- In accordance with the PUE, Section 1.2.18, the category I loads will be powered from two independent sources that provide backup to each other; the power outage that occurs as a result of a loss of a single power supply shall be permitted only for the time necessary for automatic power restoration;
- In addition to two independent power supplies required for the category 1 loads, the category I special group loads, defined in accordance with [1.3.23], Section 1.2.18, require a third independent self-sustained source that uses an automatic transfer logic (e.g. diesel generator, DC battery, uninterruptible power supply).

The NSC CS-1 design will define and justify the special group loads. These loads may include (but not be limited to) the following categories:

- Systems and electrical loads that shall remain energized in the event of postulated natural phenomena, as determined in the safety analysis;
- Emergency lighting and evacuation lighting;
- Certain parts of the HVAC system deemed susceptible to power interruption;
- Certain parts of control and monitoring systems whose continued operation is needed in the event of power interruption.

The decisions made in NSC FS (CD) will be revised and detailed in the NSC CS-1 design, and compatibility of the NSC power supply system with the existing ChNPP and OS system will be additionally considered.

2.11.3.5.2 Electrical Power Supply for Facilities and Equipment of Normal Operation

The electrical power supply system will ensure reliable power supply to all electrical loads in accordance with their category and safety classification.

The design of the electrical power supply and electrical equipment system will include the following:

- The electrical power supply and electrical equipment system which will provide for power supply to all electrical loads, including those NSC loads identified as category I, as well as the special group, as defined in [1.3.23], Sections 1.2.17 and 1.2.18;
- Lighting of NSC rooms including emergency lighting;
- Installation of cable lines of the NSC electrical system;
- Grounding and lightning protection for NSC rooms and NSC as a whole.

The following standard voltages shall be used with normal frequency of 50 Hz:

- 6 kV for power loads of 200 kW and above;
- 0.4/0.23 kV with solidity grounded neutral - for loads less than 200 kW.

All electrical cables will be provided with non-combustible insulation. The cables will be covered (if necessary) with fireproof coating.

External power supply will be provided in accordance with ChNPP technical requirements.

Electrical equipment will be selected based on all applicable standards and codes and include considerations for specific hazards, e.g., dust accumulation and seismic conditions.

Electrical equipment and motor casings will be selected to suit specific site and operating conditions, including safety classification.

Circuit breaker control will be provided in the remote mode, away from the central control room and control panels, as well as in the local mode.

The grounding system will provide for a low impedance path to protect personnel from ground faults, static discharge and lightning.

2.11.3.5.3 Electrical Power Supply for Safety Related Equipment

The electrical power supply system will ensure uninterruptible operation of all safety important equipment.

The electrical power supply system will provide with:

- Supplying electrical power to the NSC safety important systems in all modes of operation;
- Performing required functions under postulated design-basis events, and under any heat, mechanical, chemical and radiological impacts resulting from a postulated accident at the NSC;
- Ensuring required duration of work in the main power loss mode;
- Ensuring backup of electrical power supply systems;
- Emergency and evacuation lighting.

NOVARKA will provide a power supply system for NSC CS-1 and take into account needs of NSC CS-2, including:

- All necessary equipment considering the needs of both commissioning stages and equipment of appropriate rooms and areas;
- Power supply to NSC CS-1 loads;
- NSC CS-1 lighting, emergency and evacuation lighting;
- Connection points of NSC CS-2;
- Grounding/neutral earthing system;
- Lightning protection system.

Integration with existing Shelter and ChNPP systems. The integration means exchange of system data between the NSC control panel and Shelter and ChNPP systems, when necessary.

NOVARKA will provide power supply and equipment for operation and maintenance of the arch and relevant auxiliary facilities. In addition, NOVARKA will interact with the NSC CS-2 Contractor in the detailed design phase to ensure redundant capacities sufficient for NSC CS-2. The redundancy, in particular, will allow for dimensions, power and layout of electric panels, layout of the main control panel, circuits, cable boxes, lighting etc., with respect of loads

planned for NSC CS-2. Power supply and cables will be estimated so as to meet initial operating requirements and future loads for NSC CS-2. The detailed design will identify quantitative requirements for redundancy. In the first approximation, 50% redundancy may be proposed.

Redundant electric loads will be envisioned in the detailed design, including also feeders, channels, cables, breakers and other equipment in the sufficient amount and adequate characteristics (taking into account future safety classification) to cope with loads for both commissioning stages. Circuit and electric boards related to loads for NSC CS-2, will be mounted as well.

The lighting system will ensure the required level of lighting. In accordance with applicable standards and codes, the lighting circuits will be separated from power circuits.

NOVARKA will ensure protection of lighting; provide navigation signs and grounding in accordance with applicable standards and codes.

20% redundancy will be provided for unanticipated electric loads.

2.11.3.6 Communications and Industrial TV

The telephone network will be connected to the digital phone exchange with integral services that will support various telecommunication needs with a capability to establish comprehensive infrastructures of voice and data transfer, other applications in the area of broadband communication.

The telephone sets will be installed in the production and services rooms. The personnel who are engaged in operations will be provided with radio-communication means.

The wireless system will include a set of loudspeakers installed in the serviced rooms and be performed as a 3-wire circuit without the possibility of switching off any single wire.

The loudspeaker and alarm system will include a set of bell-type loudspeakers installed in the temporary-stay rooms inside the NSC and its proximity.

Notification of personnel will be performed by wire communication from the telephone located at the central control panel (CCP) and from the radiotelephone located outside the CCP and NSC.

The issues of development and compatibility with the existing and design ChNPP communication systems will be considered taking into account ChNPP decommissioning.

The system will include an industrial TV subsystem providing for operation of remotely controlled mechanisms, visual monitoring of basic technological processes.

NOVARKA will provide a communication system (this system is called “communication, alarm and notification system” in the Strategy) for NSC CS-1 and consider the needs for NSC CS-2, including:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;
- Communication, alarm and notification for NSC CS-1;
- Connection points for NSC CS-2;
- Integration with existing OS and ChNPP systems.

NOVARKA will provide an industrial TV system for NSC CS-1 and consider the needs for NSC CS-2, including:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;

- Industrial television for NSC CS-1 if necessary;
- Connection points for NSC CS-2;
- Integration with existing Shelter and ChNPP systems. The integration means exchange of system status between the NSC central control panel and Shelter systems.

2.11.3.7 Water Supply and Sewage Systems

The design of water supply and sewage will consider the following systems:

- Combined potable/technical water supply;
- Fire-fighting water supply;
- Hot water supply;
- Collection of industrial sewage (industrial sewage);
- Drainage of storm water from the NSC and NSC site (storm sewage);
- Collection of condensation moisture inside the NSC (as required);
- Domestic savage system ;
- Special savage system (liquid radwaste treatment);
- Drainage of the section for preparation of dust suppression solutions.

The connection points of the systems are presented in [3.28].

2.11.3.7.1 General Requirements

Water supply and sewage systems will be designed based on actual needs, meet existing regulatory documents and NSC specific conditions. Radiological monitoring shall be provided for the effluents. The materials, equipment and items shall provide for system efficiency without locking or freezing.

2.11.3.7.2 Combined Potable/Technical Water Supply System

Industrial- and potable water will be supplied from the network of ChNPP site potable pipeline. The material used for pipes and equipment will comply with requirements of sanitary standards.

The network of potable pipeline will be looped and of sufficient size to supply the required flow. In order to ensure necessary monitoring by sections and increase of reliability, separation and shut-off valves will be installed. Penetration of radioactive contamination to the system shall be prevented.

Water for industrial purposes (watering taps and process equipment consumption) shall be supplied from the combined industrial-portable water piping of the NSC.

NOVARKA will provide a system of combined portable/industrial water supply for NSC CS-1 and consider the needs for NSC CS-2:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;
- A system of combined portable/industrial water supply for NSC CS-1;
- Connection points for NSC CS-2.

The system draws water from the ChNPP site system.

2.11.3.7.3 Fire Water Supply System

The fire water supply system will provide for supply of sufficient amount of water to fight the external and internal fire of the facilities, and to cool down the NSC metal structures if required.

The NSC fire will be extinguished by either self-sustained system independent of the Client's system (with individual water supply and the number of fire pumps) or from the upgraded ChNPP fire-fighting system.

Internal fire-fighting will be provided from fire faucets and external from fire hydrants.

Utilization of water for fire-extinguishing will be analyzed in accordance with nuclear safety criteria for specific areas.

2.11.3.7.4 Sanitary Sewage

The sanitary sewage drainage outside the NSC will be performed with the pumping stations to the ChNPP site sanitary sewage, as indicated in [3.28]. NOVARKA will provide for measures to prevent ingress of radioactive materials into the sanitary sewage system. The feasibility of installing bio-toilets in the strict-access area restrooms will be addressed. The system will not cover areas with potential radioactive contamination.

NOVARKA will provide a sanitary sewage system for NSC CS-1 and consider the needs for NSC CS-2, including:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;
- Sanitary sewage system for both commissioning stages;
- Connection points for the sewage collection system for NSC CS-2 (when necessary, if the previous item cannot be provided in full scope).

The NSC CS-1 sanitary sewage system is connected to the ChNPP sanitary sewage system.

2.11.3.7.5 Industrial Sewage

Industrial Sewage will be sent to the storm sewage system through a sump for oil skimming. Shut-off radiological monitoring will be needed; radiological monitoring will be required before discharge. Measures will be provided to prevent ingress of radioactive media to the system (e.g., the system will not be installed in areas with potential radioactive contamination).

NOVARKA will provide an industrial sewage system for NSC CS-1 and consider the needs for NSC CS-2, including:

- All necessary equipment taking into account needs of both commissioning stages and equipment of appropriate rooms and areas;
- Industrial sewage for NSC CS-1 and stationary places for collection of floor drains for NSC CS-2;
- Connection points for portable (if necessary, stationary) collection means for NSC CS-2.

2.11.3.7.6 Storm Sewage

Diversion of the storm water from the NSC roof shall be organized through the system of closed pipings or open channels. Optimal option of the storm water (without radioactive contamination) diversion from the roof shall be additionally developed and justified in the Detailed design together with connection to the combined ChNPP systems without purification.

Diversion of the storm water from the NSC site shall be performed to the similar network with preliminary purification mainly of mechanic admixtures and possible oil products. Radiation monitoring of the diverted water should be envisioned.

The NSC CS-1 Contractor shall provide storm sewage system for the NSC, including:

- all basic equipment (system of the outlet pipes and channels from the NSC roofing, from the existing OS structures protruding beyond the arch as well as from other buildings and facilities of the NSC);
- collection system for rain and melt water (also from the NSC site), main pipelines and channels to the storm sewage outlet
- provide storm water sewage system for both commissioning stages

The NSC CS-1 storm sewage system will be connected to the ChNPP site storm sewage system, defined by SSE ChNPP answer, to be the discharge channel of Unit 4 or of Unit 3, running parallel to the Turbine Hall.

2.11.3.7.7 Special Drainage System (Liquid Radwaste Treatment System)

Design of the LRAW management system shall be developed with collection for removal from the NSC to the ChNPP system.

LRAW management facilities should ensure collection of the primary and secondary LRAW and their **hand-over** to the LRAW management system of ChNPP.

NOVARKA will provide a special drainage system for NSC CS-1 and consider the needs for NSC CS-2, including:

- All necessary equipment taking into account needs of NSC CS-1 and NSC CS-2 arrangement of the respective premises and areas;
- Liquid radwaste collection system (special drainage) and mobile equipment for NSC CS-1 and stationary places for liquid radwaste collection for NSC CS-2;
- Connection points to the liquid radwaste collection system for mobile (if necessary, stationary) equipment for liquid waste collection for NSC CS-2.
- Systems for quantity and activity control of resulting sewage.

2.11.3.7.8 Collection of Condensation Humidity inside NSC (if necessary)

If condensate is generated on the internal surface of the NSC, possibility of its diversion into the special sewage system with radiation monitoring shall be considered, since condensate may contain unacceptable levels of radioactive contamination.

2.11.4 ACCESS CONTROL SYSTEM

NSC CS-1 Contractor shall reserve an empty room (with a surface area roughly estimated at 70 m²) at the entrance of the NSC Auxiliary (technological) facility for future installation (by others) of access control and physical protection equipment (turnstiles, card reader etc.). NSC CS-1 Contractor will determine actual area required.

NOVARKA shall equip doors on access routes to the restricted areas, zones and equipment with sensors and locks. Sensors signal shall be transmitted to the Access Control and Physical Protection System developed and installed by others

2.11.5 DECONTAMINATION AND PERSONNEL SANITARY TREATMENT SYSTEM

The Design of RAW management, generated during decontamination and sanitary treatment of personnel will be performed, taking into account the needs of maintenance for NSC CS-1 structures and reservation of power capacities for NSC CS-2.

In NSC, the quantity of personnel in the maximum work shift for the period of dismantling the unstable structures will be around 120 persons, without taking into account the personnel which periodically stays in a shielding box *(OS personnel)*. The expected quantity of personnel during the period prior to the beginning of dismantling works shall be approximately made of 60 persons during the maximum work shift. The personnel of sanitary check points and those carrying out the radiation monitoring is includes in these quantities*.* The aforementioned assessment of quantity of the NSC operation personnel is preliminary and will be clarified and justified in the design.

In the development of methods, compositions and technical means of decontamination, preference will be given to non-liquid and small-capacitance technologies. As a basis the compositions and methods that are currently used in the Shelter will be considered. The effectiveness of the newly proposed compositions and methods will be not less than those that are currently used.

For the personnel sanitary treatment system, the following will be addressed:

- Requirements for access routes for personnel to their workplaces (through changing facility, sanitary check points, including the use of existing and to-be-designed facilities);
- Requirements for collection, monitoring and discharge of water after sanitary treatment of personnel;
- Requirements for the use of additional individual protection means,
- Requirements for the use of pneumatic suits and masks;
- Requirements for equipment of mobile and stationary airlocks, their sanitary treatment. In particular, the movement of air flows from “clean” to “dirty” zones will be provided;
- Requirements which specify resistance to decontamination compounds and prevention of radioactive contamination sorption to materials and equipment.

Design of sanitary-accommodation space (SAS) will be realized in accordance with the requirements of ОСПУ and other applicable normative documents.

Detail work over the stated above issues will be realized at the Design stage.

Item 12.6 ОСПУ-2005 estimates the requirements for SAS, which will be realized during NSC designing. In SP-AS-88, some ОСПУ-2005 requirements have been detailed. Attachment 2.4 presents the extracts from the main ОСПУ-2005 and СП-АС-88 requirements (indicating the items, given in ОСПУ-2005 and СП-АС-88), Applications of the stated requirements will be adapted to the concrete specific NSC conditions and the ChNPP site in a total, as well as to the existing ChNPP infrastructure. Here, ОСПУ-2005 will be considered as main document, but СП-АС-88, as an auxiliary one, meant to detail some requirements of ОСПУ-2005.

NOVARKA will provide with the sanitary treatment system for the personnel of NSC CS-1, taking into account the needs of NSC CS-2, addressed both to decontamination and sanitary treatment for the personnel, including:

- Decontamination equipment for NSC CS-1, and partially, for NSC CS-2 needs and equipment of appropriate rooms and areas. The equipment and instrument decontamination shop will take into account needs for decontamination of portable equipment (devices,

rigging, grippers, tools) to be used in dismantling. The same will be relative to decontamination of crane equipment, handling and other mechanisms, containers, process and other equipment, transport (in particular, at NSC exit), as well as individual and collective protective means. Scope of the CS-1 does not include equipment for decontamination of the dismantling structures of main equipment (special for dismantling), that will be decontaminated on the dismantling spots, site of accomplished RAW. Also special mechanisms for loading and unloading of the dismantled structures and RAW are not included. The NSC CS-1 decontamination system will take into account the needs for decontamination of rooms, areas, access routes, and, if possible, needs of decontamination sites for the dismantled structures management (primary treatment, preparatory for temporary storage and loading;

- Provision of the NSC CS-1 with decontamination system;
- Places for connection of the NSC CS-2;
- Stationary air locks on boundaries of NSC zones, in process facility. Inside NSC for both complexes;
- Mobile air locks for NSC CS-1 (if necessary).

2.11.6 NSC FACILITIES

The NSC CS-1 will include the following auxiliary facilities:

1. Sites, structures inside the NSC determining its internal layout (considering dismantling) in compliance with structural arrangement solutions, in particular:

- Sites and structures for dismantling equipment (including its storage) and places for connection of life support systems and the state monitoring system too;
- Sites and structures for primary treatment of dismantled structures, including as follows:
  - Walls and the facility’s roofing with embrasure for delivery of dismantled structures, equipped by biological protection;
  - Reserve for railways to be laid out for 15-tonne trolleys;
  - Reserve to lay railways for semigantry (20 ton) crane installed from the vehicles loading area to the initial treatment area;
  - Local reinforcement of covering in area of loading as well as under garage of maintenance for carriages of main cranes;
  - Places of connection points for life-support systems and NSC status control system.
- Site and structures for handling of dismantled structures, including:
  - Reserve for railways to be laid out for 15-tonne trolleys;
  - Reserve for railways, meant crane (20t) throughout the territory, from railways, laid down at the site for vehicle loading;
  - Foundations for walls of biological protection to provide the radiation zoning;
  - Walls and roofing of the facility;
  - Places of connection points for life-support system and NSC status control system.
- Site and structures for temporary storage of dismantled structures, south gate and air locks for large transport vehicles, including, as follows:

- Development of the site for temporary storage , that is, i.e., its equipping with all the necessary life-support systems and status control ones;
- Southern sliding gates of the western end wall with a control panel;
- Air lock for transportation of the materials and equipment, equipped with all the required systems of life-support and status control;
- Creation of required conditions of subsequent expansion of systems, including, but not restricting: decontamination, LRAW collection, mobile screening (shielding).

- Site and structures for loading of vehicles, north gate and air lock for standard transport vehicles, including:
  - Access gate for standard vehicle; point of output monitoring for waste and vehicle radiation contamination;
  - Crane (20 tonne) with a system of manual control, and railways laid out till a site for primary processing;
  - Ventilation systems ensuring the non-spreading of contamination outside the Arch under opening of gates;
  - Other systems of life support and status monitoring;
- Site for temporary storage of packaged RAW, including a redundancy of squares for buffer storage of containers, based upon NSC FS (CD) information.
- Site for preparation of solutions for the new mobile dust suppression system (transported by cranes) and piping from the site to the mobile DSS. It is foreseen, that this site will be used for the same purpose in future as well. It is required for OS dismantling, and after that, it may be used for preparation of dust suppression solutions for mobile dust suppression system. Reasoning of that, a long term access to the existing dust suppression site and pipeline from that site to new mobile DSS, will be ensured.
- Solid insulating covering of the open soil areas inside the NSC and arrangements for sewage collection & management of liquid LLRAW.
- Structures for the sanitary check points on the boundaries and inside NSC meant for both commissioning complexes.
- Access and evacuation routes, emergency exits inside the NSC.

2. Auxiliary (process) building, including (Section 10.2.2.1 and section. 2 of Attachment 2 [1.12.11]):
   - Rooms, areas, ensuring the operation of NSC life supporting and monitoring systems;
   - Air locks;
   - Equipment maintenance and repair shops;
   - Equipment decontamination shop;
   - Radiological monitoring shop;
   - Offices;
   - Structures for input ventilation systems of the arch and ring gap (these structures may be designed separately from the auxiliary building).

3. NSC offsite utilities and external arrangements (up to the points of tie-in to ChNPP utilities):
4. Buildings and facilities for allocation and operation of life support systems which are not included into the aforementioned auxiliary (processing) buildings". Pursuant to the NSC Strategy, this is a sewage pump station, building for fire-fighting etc. See TT Clarifications etc.
5. Covering and construction of NSC site, as well as the infrastructure buildings and facilities on the NSC site" (see NSC Strategy, TT Clarifications, NSC DD in part of general layout and transport systems etc.)

Note. Other facilities included in the NSC CS-1 and those associated with the arch will be regarded, as part of the main NSC structure. The main structure will include:

- Carrying structures of the arch;
- West and east end walls;
- Foundations;
- NSC internal and external enclosure system, including maintenance system;
- Interfaces with existing ChNPP structures;
- All necessary structures, equipment, liens and etc., of the sliding system;
- A system of the main cranes, maintenance structures, storages of crane trolleys,
- Fastenings of hinged equipment etc., special trolley with telescopic mast.

2.11.7 SPECIFIC CRITERIA DEFINED DURING THE DETAILED DESIGN

The above CDSD sections do not provide specific design criteria and requirements for structures of equipment and pipelines, structures of industrial equipment cabinets, arrangement of cable lines, protection of systems and equipment against non-authorised access, technical diagnosing, software and its testing. These design criteria and requirements will be determined during the Design and submitted for concurrence by the Regulatory Authorities.

Initially, the following can be stated:

- These items always relate to major system, structure or components of the NSC and will inherit their classification. For instance, a cable line feeding a SSC IS-1 will be also ranked as IS-1 and will be subject to the design provisions applicable stated in section 2.6.
- High-class items (IS-1) which might be damaged by failures of lower class items will be located in separated areas. This separation might be achieved either by protective structures (walls) or by distance. The selection of the separation technique will be provided during the Design;
- The reliability of the safety important items will be determined in a way similar to SSC in strict accordance with 2.6.3.

ATTACHMENTS TO CHAPTER 2

A.2.1 – NORMS AND STANDARDS

1. **НПА и НД, применяемые при разработке проекта ПК-1 НБК / NLA and ND to be Applied for the NSC CS-1 Development**

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.1. Законы Украины, законодательные акты и постановления Кабинета Министров Украины / 1.1. Laws Ukraine, legislative acts and decrees of Cabinet of Ministers of Ukraine				
Законы / Law				
1.1.1	Про використання ядерної енергії та радіаційну безпеку	Верховна Рада України	39/95- ВР	08.02.1995
	On use of nuclear energy and radiation safety	Supreme Rada of Ukraine		
1.1.2	Про поводження з радіоактивними відходами	Верховна Рада України	255/95-ВР	30.06.1995
	On radioactive waste management	Supreme Rada of Ukraine		
1.1.3	Про екологічну експертизу	Верховна Рада України	45/95-ВР	09.02.1995
	On ecological expert review	Supreme Rada of Ukraine		
1.1.4	Про забезпечення санітарного та епідеміологічного благополуччя населення	Верховна Рада України	4004-XII	24.02.1993
	On assurance of sanitary and epidemiological well-being of population	Supreme Rada of Ukraine		
1.1.5	Про охорону навколишнього природного середовища	Верховна Рада України	1264-XII	25.06.1991
	On environment protection	Supreme Rada of Ukraine		
1.1.6	Про захист людини від впливу іонізуючого випромінювання	Верховна Рада України	15/98-ВР	14.01.1998
	On the protection of people against the effects of ionizing radiation	Supreme Rada of Ukraine		
1.1.7	Про загальні засади подальшої експлуатації і зняття з експлуатації Чорнобильської АЕС та перетворення зруйнованого	Верховна Рада України	309-XIV	11.12.1998

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	четвертого енергоблока цієї АЕС на екологічно безпечну систему			
	On general principles of further operation and decommissioning of Chernobyl NPP and transformation of ruined fourth power unit of this NPP into ecologically safe system	Supreme Rada of Ukraine		
1.1.8	Про наукову і науково-технічну експертизу	Верховна Рада України	51/95-ВР	10.02.1995
	On scientific and scientific and technical expert review	Supreme Rada of Ukraine		
1.1.9	Про фізичний захист ядерних установок, ядерних матеріалів, радіоактивних відходів, інших джерел іонізуючого випромінювання	Верховна Рада України	2064-III	19.10.2000
	On physical protection of nuclear installations, nuclear materials, radioactive waste, and other sources of ionizing radiation	Supreme Rada of Ukraine		
1.1.10	Про пожежну безпеку	Верховна Рада України	3745-XII	17.12.1993
	On fire safety	Supreme Rada of Ukraine		
1.1.11	Про охорону праці	Верховна Рада України	2694-XII	14.10.1992
	On labour protection	Supreme Rada of Ukraine		
1.1.12	Про охорону атмосферного повітря	Верховна Рада України	2707-XII	16.10.1992
	On atmospheric air protection	Supreme Rada of Ukraine		
1.1.13	Про відходи	Верховна Рада України	187/98-ВР	05.03.1998
	On waste	Supreme Rada of Ukraine		
1.1.14	Про правовий режим території, що зазнала радіоактивного забруднення внаслідок Чорнобильської катастрофи	Верховна Рада України	791а-XII	27.02.1991
	On legal status of the area exposed to radioactive contamination as a result of Chernobyl catastrophe	Supreme Rada of Ukraine		
1.1.15	Про об'єкти підвищеної небезпеки	Верховна Рада України	2245-III	18.01.2001

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	On facilities with increased hazard	Supreme Rada of Ukraine		
1.1.16	Про дозвільну діяльність у сфері використання ядерної енергії	Верховна Рада України	1370-XIV	11.01.200
	On licensing activity in the field of nuclear energy utilisation	Supreme Rada of Ukraine		
1.1.17	Про підтвердження відповідності	Верховна Рада України	2406-III	17.05.2001
	On conformity assessment	Supreme Rada of Ukraine		
1.1.18	Про ратіфікації Об'єднаної Конвенції про безпеку поводження з відпрацьованим паливом та про безпеку поводження з радіоактивними відходами	Верховна Рада України	1688-14	20.04.2000
	On ratification joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Supreme Rada of Ukraine		
1.1.19	Про метрологію та метрологічну діяльність	Верховна Рада України	113/98-ВР	11.02.1998
	On metrology and metrological activity	Supreme Rada of Ukraine		
1.1.20	Про охорону земель	Верховна Рада України	962-IV	19.06.2003
	On land protection	Supreme Rada of Ukraine		
Постановления / Decrees				
1.1.21	Про затвердження техніко-економічного обґрунтування (Концептуальний Проект) конфайнмента об'єкта «Укриття» Чорнобильської АЕС	Кабінет Міністрів України	443-Р	05.07.2004
	On approval of feasibility study (conceptual design) for Chernobyl NPP Shelter object confinement	Cabinet of Ministers of Ukraine		
1.1.22	Про затвердження Порядку виконання Плану здійснення заходів на об'єкті «Укриття»	Кабінет Міністрів України	421	31.03.2003

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	On approval of procedure for realisation of the Shelter implementation plan	Cabinet of Ministers of Ukraine		
1.1.23	Про Порядок прийняття в експлуатацію закінчених будівництвом	Кабінет Міністрів України	1243	22.09.2004
	On procedure on commissioning of complete construction facilities	Cabinet of Ministers of		
1.1.24	Про Порядок затвердження інвестиційних программ і проектів будівництва та проведення їх комплексної державної експертизи	Кабінет Міністрів України	483	11.04.2002
	On order of approval for investment programs and construction projects and its comprehensive state examination.	Cabinet of Ministers of Ukraine		
1.1.25	Про Державну программу поводження з радіоактивними	Кабінет Міністрів України	480	29.04.1996
	On provisions on state register of radioactive waste	Cabinet of Ministers of		
1.1.26	Поручение на разработку документа по безопасности в рамках концепции проекта НБК	Кабинет Министров Украины	9180/3/1-06	27.03.2006
	Order for development of safety document within the framework of NSC design conception	Cabinet of Ministers of Ukraine		
1.1.27	Положення про порядок проведення державної експертизи (перевірки) проектної документації на будівництво та реконструкцію виробничих об'єктів і виготовлення засобів виробництва на відповідність їх нормативним актам про охорону праці	Кабінет Міністрів України	431 (НПАОП 0.00-4.20-94)	23.06.1994
	Provisions for order of state examination (inspection) addressed to design documents for construction, reconstruction of industrial enterprises for compliance with the regulatory acts on labour protection.	Cabinet of Ministers of Ukraine		

№ п/п /No.	**Название документа / Document Title**	**Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document**	**Номер документа/ Document Reference**	**Дата/Date**
1	**2**	**3**	**4**	**5**
1.2. Нормы и правила по радиационной и ядерной безопасности, обращению с ядерными материалами и РАО / 1.2.Codes and regulations for radiological and nuclear safety, nuclear materials and radwaste management				
1.2.1	Норми радіаційної безпеки України. Державні гігієнічні нормативи (НРБУ-97)	МОЗ України	ДГН 6.6.1-6.2.001-98	14.07.1997
	Radiation safety norms of Ukraine. State hygienic regulations (НРБУ-97)	Ministry of Health of Ukraine		
1.2.2	Норми радіаційної безпеки України. Доповнення: Радіаційний захист від джерел потенційного опромінення. Державні гігієнічні нормативи (НРБУ-97/Д2000)	МОЗ України	ДНАОП 0.03-3.24-97 (ДГН 6.6.1-6.5.061-98)	01.01.1998
	Radiation safety norms of Ukraine, addition: potential radiation source protection. State hygienic regulations (НРБУ-97/Д2000)	Ministry of Health of Ukraine		
1.2.3	Основні санітарні правила забезпечення радіаційної безпеки України (ОСПУ-2005)	МОЗ України	ДСП 6.177-2005-09-02	02.02.2005
	Basic sanitary rules for radiation protection of Ukraine (ОСПУ-2005)	Ministry of Health of Ukraine		
1.2.4	Правила ядерної та радіаційної безпеки при перевезенні радіоактивних матеріалів (ПБПРМ-2006)	ДКЯРУ	НП 306.6.124-2006	30.08.2006
	Nuclear and radiation safety rules for transportation of radioactive materials (ПБПРМ -2006)	SNRC of Ukraine		
1.2.5	Положення щодо планування заходів та дій на випадок аварій під час перевезення радіоактивних матеріалів	ДКЯРУ	НП 306.6.108-2005	07.04.2005

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Regulations regarding planning of measures and actions for case of accidents during transportation of radioactive materials	SNRC of Ukraine		
1.2.6	Проектні допустимі рівні для нового безпечного конфайнмента	МОЗ України, ДКЯРУ		2005
	Designed permissible levels for new safe confinement	Ministry of Health of Ukraine, SNRC of Ukraine		
1.2.7	Проектні критерії обмеження потенційного опромінення для НБК	МОЗ України, ДКЯРУ		2005
	Design criteria of potential irradiation restriction for NSC	Ministry of Health of Ukraine, SNRC of Ukraine		
1.2.8	Заява про політику регулювання ядерної та радіаційної безпеки об'єкту «Укриття» ВП Чорнобильська АЕС	Мінекоресурсів України		08.04.1998
	Statement on regulation policy for SSE ChNPP's OS nuclear and radiation safety	Ministry of the Environmental Protection		
1.2.9	Фундаментальні принципи безпеки діяльності в рамках Плану здійснення заходів на об'єкті Укриття	ДКЯРУ	НП 306.1.102-2004	30.12.2004
	Fundamental principles of safe activity within SIP realization	SNRC of Ukraine		
1.2.10	Керівництво щодо застосування засад безпеки під час здійснення регулюючої діяльності в рамках Плану здійснення заходів на об'єкті «Укриття»	ДКЯРУ	РД 306.1.128-2006	25.09.2006
	Guidance addressed to safety measures during regulatory activity in the frameworks of SIP realization	SNRC of Ukraine		

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1	2	3	4	5
1.2.11	Правила проектирования и эксплуатации систем аварийной сигнализации о возникновении самоподдерживающейся цепной реакции и организации мероприятий по ограничению ее последствий	Госатомнадзор СССР	ПБЯ-06-10-91	21.02.1991
	Rules for design and operation of emergency alarm system signaling of self-sustained chain reaction origination and organization of neasures for limitation of its consequences	State Nuclear inspection of USSR		
1.2.12	План реагування на радіаційні аварії	ДКЯРУ	НП 306.5.01/3.083-2004	17.05.2004
	Radiation emergency rersponse plan	SNRC of Ukraine		
1.2.13	Правила безопасности при хранении и транспортировке ядерного топлива на объектах атомной энергетики	Госатомнадзор СССР	ПНАЭ Г -14-029-91	1991
	Safety rules for storage and transportation of nuclear fuel at nuclear industry facilities	State Nuclear inspection of USSR		
1.2.14	Стратегия преобразования объекта «Укрытие»	Межведомственная комиссия по вопросам комплексного решения проблем ЧАЭС	протокол №2 / Note No 2	15.03.2001
	Shelter object conversion strategy	Commite on Issues of Comprehensive of Chernobyl NPP Problems		
1.2.15	Нормы проектирования сейсмостойких атомных станций	Госатомнадзор СССР	ПНАЭ Г-5-006-87	30.12.1987

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Norms for design of erthquake resistant nuclear plants	State Nuclear inspection of USSR		
1.2.16	Основания реакторных отделений атомных станций	Госатомнадзор СССР	ПиН АЭ 5.10-87	11.01.989
	Nuclear plant reactor unit basis	State Nuclear inspection of USSR		
1.2.17	Нормы строительного проектирования атомных электростанций с реакторами различного типа	Госатомнадзор СССР	ПиН АЭ-5.6	29.12.1986
	Norms for construction design of nuclear plants with reactors of different types	State Nuclear inspection of USSR		
1.2.18	Правила забезпечення збереження ядерних матеріалів, радіоактивних відходів, інших джерел іонізуючого випромінювання	Мінекоресурсів України	НП 306.4.08/1.042-00	2000
	Rules of provisions with preservation of nuclear materials, radioactive waste, other sources of ionizing radiation	Ministry of Ecological Resources of Ukraine		
1.3. Правила и нормы технической безопасности, охраны труда и пожарной безопасности / 1.3. Codes and regulation for industrial, labor protection and fire safety				
1.3.1	Правила безпеки під час реконструкції будівель і споруд промислових підприємств	Мінпраці України	НПАОП 45.2-1.12-01	02.04.2001
	Safety rules applicable to reconstruction of the industrial enterprises structure	Ministry of Labour of Ukraine		
1.3.2	Правила безпечного виконання робіт при спорудженні об'єктів з монолітного бетону та залізобетону	Держнаглядохоронпраці України	НПАОП 45.2-1.11-97	14.03.97

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Rules of safe work implementation during erection of monolithic concrete and reinforcement concrete objects	Inspectorate of Labour Protection of Ukraine		
1.3.3	Орієнтовно безпечні рівні дії шкідливих речовин у повітрі робочої зони	МОЗ України	ДНАОП 0.03-3.20-00	23.02.2000
	Tentatively safe level of activity for hazardous substances in a work zone air	Ministry of Health of Ukraine		
1.3.4	Санитарные правила организации технологических процессов и гигиенические требования к производственному оборудованию	МОЗ України	СП 1042-73 (ДНАОП 0.03-1.07-73)	04.04.1973
	Sanitary rules of engineering process organization and hygienic requirements for industrial equipment	Ministry of Health of Ukraine		
1.3.5	Санітарні норми виробничого шуму, ультразвуку та інфразвуку	МОЗ України	ДСН 3.3.6.037-99	01.12.1999
	Sanitary norms for industrial noise, ultrasound and infrasound	Ministry of Health of Ukraine		
1.3.6	Правила техники безопасности при эксплуатации теплоиспользующих установок и тепловых сетей	Мінпаливенерго України	ДНАОП 0.00-1.22-95	14.02.2007
	Safety rules for operation of heat- utilizing facilities and heat networks	Ministry of Fuel and Energy of Ukraine		
1.3.7	Правила безпечної експлуатації електроустановок споживачів	Держнаглядохоронпраці України	НПАОП 40.1-1.21-98	09.01.1998
	Rules for safe operation of facilities by the users	Inspectorate of Labour Protection of Ukraine		
1.3.8	Правила устройства и безопасной эксплуатации подъемников	Держнаглядохоронпраці України	НПАОП 0.00-1.36-03	08.12.2003

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Rules for design and safe operation of hoisters	Inspectorate of Labour Protection of Ukraine		
1.3.9	Правила устройства и безопасной эксплуатации сосудов, работающих под давлением. Изменение №1, 11.07.1997. Изменение №2, 22.03.2002	Держнаглядохоронпраці України, Мінпраці України	НПАОП 0.00-1.07-94	18.10.1994
	Rules for design and operation of vessels operating under pressure. Alteration No.1, 11.07.1997. Alteration No.2, 22.03.2002	Inspectorate of Labour Protection of Ukraine, Ministry of Labour of Ukraine		
1.3.10	Правила устройства и безопасной эксплуатации стационарных компрессорных установок, воздуховодов и газопроводов	Госгортехнадзор СССР	НПАОП 0.00-1.13-71	07.12.1971
	Rules for design and safe operation of stationary compressor units, airways and gas pipelines	USSR State Mining Inspectorate		
1.3.11	Правила безпечної експлуатації електроустановок. Изменение, 25.02.2000	Держнаглядохоронпраці України	НПАОП 40.1-1.01-97	06.10.1997
	Rules for safe operation of electroinstallations. Alteration, 25.02.2000	Inspectorate of Labour Protection of Ukraine		
1.3.12	Правила будови електроустановок. Електрообладнання спеціальних установок	Мінпраці України	НПАОП 40.1-1.32-01	21.06.2001
	Rules for electric units construction. Electric equipment for the specific units	Ministry of Labour of Ukraine		
1.3.13	Правила будови і безпечної експлуатації трубопроводів пари і гарячої води. Изменение, 06.03.2002	Держнаглядохоронпраці України	НПАОП 0.00-1.11-98	08.09.1998

№ п/п /No.	**Название документа / Document Title**	**Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document**	**Номер документа/ Document Reference**	**Дата/Date**
1	**2**	**3**	**4**	**5**
	Rules for construction and safe operation of steam and hot water pipelines. Alteration, 06.03.2002	Inspectorate of Labour Protection of Ukraine		
1.3.14	Правила пожежної безпеки в Україні	МНС України	НАПБ А.01.001-2004	19.10.2004
	Rules of fire safety of Ukraine	Ministry of Ukraine of Emergencies		
1.3.15	Норми визначення категорій приміщень, будинків та зовнішніх установок за вибухопожежною та пожежною небезпекою	МНС України	НАПБ Б.03.002-2007	03.12.2007
	Norms of buildings rooms and external installations categories classification on fire-explosive and fire hazard	Ministry of Ukraine of Emergencies		
1.3.16	Общие положения по обеспечению пожарной безопасности объекта «Укрытие»	ГСП ЧАЭС, Главное управление государственной пожарной охраны МВД Украины	НАПБ 02.021-1999	07.06.1999
	Basic regulations to ensure fire safety of the object Shelter	SSE ChNPP, General Department of State Fire Fighting Service of the Ministry of Internal Affairs of Ukraine		
1.3.17	Правила пожежної безпеки в компаніях, на підприємствах та в організаціях енергетичної галузі України	Мінпаливенерго України	НАПБ В.01.034-2005/111	26.07.2006
	Rules for safety assurance in companies, enterprises and institutions of energy branch of Ukraine	Ministry of Fuel and Energy of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.3.18	Захист від пожежі. Пожежна безпека об'єктів будівництва. Зміна №1-БіС№2, 23.01.2007	Держбуд України	ДБН В.1.1-7-2002	03.12.2002
	Protection from fire. Construction fire safety. Alteration No.1-BiS No.2, 23.01.2007	Gosstroy of Ukraine		
1.3.19	Нормы проектирования автоматических установок пожаротушения кабельных сооружений	Минэнерго СССР	ВСН 47-85	1985
	Norms for designing of automatic fire extinguishing facilities applicable for cable construction	Ministry of Energy of USSR		
1.3.20	Противопожарные нормы строительного проектирования. Методика определения расчетной пожарной нагрузки	Госкомитет СССР по делам строительства	СТ СЭВ 446-77	26.12.1977
	Fire norms for construction design. Procedure for calculation of fire loads	State Committee of USSR on Building Affairs		
1.3.21	Правила будови і безпечної експлуатації вантажопідіймальних кранів	Держнаглядохорони праці України	НПАОП 0.00-1.01-07	18.06.2007
	Rules of construction and safe operation of cranes	Inspectorate of Labour Protection of Ukraine		
1.3.22	Правила техники безопасности при эксплуатации тепломеханического оборудования электростанций и тепловых сетей	Держнаглядохоронпраці України	НАОП 1.1.10-1.02-01	15.11.2001
	Industrial safety rules during operation of heat-mechanic equipment of electric power stations and heat networks	Inspectorate of Labour Protection of Ukraine		
1.3.23	Правила устройства электроустановок	Минэнерго СССР	ПУЭ:2006	2006

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Rules for set-up of electrical installations	Ministry of Energy of USSR		
1.3.24	Пожарная безопасность в строительстве. Термины и определения	Постоянная комиссия по сотрудничеству в области строительства	СТ СЭВ 383-87	1987
	Fire safety for construction design. Terms and definitions	Permanent Commission for Construction Cooperation		
1.3.25	Противопожарные нормы проектирования атомных электростанций с водо-водяными энергетическими реакторами	Мінпаливенерго України	ВБН В.1.1-034-03.307-2003 (НАПБ 03.005-2007)	2003
	Fire- prevention design norms of nuclear power plants operating with water-moderated water-cooled reactors	Ministry of Fuel and Energy of Ukraine		
1.4 Правила и нормы физической защиты объектов, контроля и учета ядерных материалов / 1.4. Codes and standarts for physical protection of facilities, control and accounting of nuclear materils				
1.4.1	Правила фізичного захисту ядерних установок та ядерних матеріалів	ДКЯРУ	НП 306.8.126-2006	04.08.2006
	Rules of physical protection of nuclear material and nuclear facilities	SNRC of Ukraine		
1.4.2	Правила ведення обліку та контролю ядерних матеріалів	ДКЯРУ	НП 306.7.122-2006	26.06.2006
	Rules of nuclear materials recording and monitoring	SNRC of Ukraine		
1.4.3	Правила повадження з інформацією щодо фізичного захисту ядерних установок, ядерного матеріалу, інших джерел іонізуючого випромінювання	Мінекобезпеки України	НП 306.4.08/1.014-98	28.12.1998
	Rules for treating information on physical protection of nuclear installations, nuclear material, other ionizing radiation sources	Ministry of Environmental Safety of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.4.4	Положення про визначення характеристик можливого нападу на ядерні установки і ядерні матеріали та використання цих відомостей у фізичному захисті	ДКЯРУ	НП 306.2.08/1.015-99	30.09.1999
	Procedures for determining characteristics of possible attack on nuclear installations and nuclear material and their utilization for physical protection purposes	SNRC of Ukraine		
1.4.5	Положення про систему вимірювань ядерних матеріалів	ДКЯРУ	НП 306.7.120-2006	13.02.2006
	Provision for nuclear materials measurement	SNRC of Ukraine		
1.4.6	Рекомендації щодо обліку малих кількостей ядерних матеріалів	ДКЯРУ	РД 306.7.111-2005	26.09.2005
	Recommendations for account of small quantities of nuclear materials	SNRC of Ukraine		
1.4.7	Методичні вказівки щодо проведення фізичної інвентаризації та зведення балансу ядерних матеріалів	ДКЯРУ	РД 306.7.112-2005	06.10.2005
	Methodical instructions for physical inventory and report of nuclear materials balance	SNRC of Ukraine		
1.4.8	Система надійності будівництва (СНББ). Положення про розслідування причин аварій (обвалень) будівель, споруд, їх частин та конструктивних елементів	Держнаглядохоронпраці України	ДБН В.1.2-1-95	01.07.1995
	Construction reliability system (CRS). Regulations for investigation of the emergencies (collapses): facilities, structure, their components and structural elements	Inspectorate of Labour Protection of Ukraine		
1.4.9	Правила эксплуатации электрозащитных средств	Мінпраці України	НПАОП 40.1-1.07-01	05.06.2001
	Operational regulations for electricity-preventive means	Ministry of Labour of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.4.10	Инженерное оборудование зданий и сооружений. Пожарная автоматика зданий и сооружений. Поправка - ИБ №11, 2005. Изменение №1, 2006	Держбуд України	ДБН В.2.5-13-98*	22.05.2006
	Engineering equipment of buildings and facilities. Fire automatics of buildings and facilities. Amendment - IB No.11, 2005. Alteration No.1, 2006	Gosstroy of Ukraine		
1.4.11	Инструкция по устройству молниезащиты зданий и сооружений	Минэнерго СССР	РД 34-21.122-87	12.10.1987
	Instruction on installation of lightning protection for buildings and structures	Minenergo of USSR		
1.5. Общепромышленные нормы и правила и нормы для систем водоснабжения, канализации, отопления, вентиляции и кондиционирования / 1.5. Common industrial codes and standards for water supply, sewerages, heating, ventilation and conditioning				
1.5.1	Водоснабжение. Наружные сети и сооружения. Поправки - БСТ № 9,11,1985; БСТ 2,12,1987. Изменения - БСТ № 9,1986, изм.№1 - БиС № 2, 2000	Госстрой СССР	СНиП 2.04.02-84*	27.07.1984
	Water supply. External utilities and structures Amendments - BST No.9,11,1985; BST 2,12,1987. Alterations - BST No.9,1986, change No.1 - BiS No.2, 2000	Gosstroy of USSR		
1.5.2	Внутренний водопровод и канализация зданий. Изменения - БСТ № 7, 1992. Поправки - БСТ № 11, № 12, 1992. Дополнение - БУ № 2, 1995	Госстрой СССР	СНиП 2.04.01-85	04.12.1985
	Internal water pipeline and sewage of buildings. Alterations - BST No.7, 1992.	Gosstroy of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Amendments - BST No.11, No.12, 1992. Attachment - BU No.2, 1995			
1.5.3	Отопление, вентиляция и кондиционирование. Дополнение БУ - №2, 1995. Изменение №1. Изменение №2 - БиС №1, 2000. Изменение №2 - БиС №1, 2001	Госстрой Украины	СНиП 2.04.05-91	1991
	Heating, ventilation and conditioning. Attachment BU - No.2, 1995. Alteration No.1. Alteration No.2 - BiS No.1, 2000. Alteration No.2 – BiS No.1, 2001	Gosstroy of Ukraine		
1.5.4	Тепловая изоляция оборудования и трубопроводов	Госстрой СССР	СНиП 2.04.14-88	1990
	Thermal insulation of equipment and pipelines	Gosstroy of USSR		
1.5.5	Наружные сети и сооружения водоснабжения и канализации	Госстрой СССР	СНиП 3.05.04-85*	31.05.1985
	External networks and water supply facilities and sewerages	Gosstroy of USSR		
1.5.6	Канализация. Наружные сети и сооружения. Изменение - БСТ № 9, 1986. Изменение №1 - БиС № 2, 2000	Госстрой СССР	СНиП 2.04.03-85	21.05.1985
	Sewage. External utilities and structures. Alteration - BST No.9, 1986. Alteration No.1 - BiS No.2, 2000	Gosstroy of USSR		
1.5.7	Тепловые сети. Изменение №1 - БУ № 2, 1995. Изменение №2 - БиС № 1, 2000.	Госстрой СССР	СНиП 2.04.07-86	30.12.1986

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Изменение №2 - БиС № 1, 2001			
	Heating utilities. Alteration No.1 - BU No.2, 1995. Alteration No.2 - BiS No.1, 2000. Alteration No.2 - BiS No.1, 2001	Gosstroy of USSR		
1.6 Правила и нормы охраны окружающей среды / 1.6 Environmental protection codes and standarts				
1.6.1	Состав и содержание материалов оценки воздействий на окружающую среду (ОВОС) при проектировании и строительстве предприятий, зданий и сооружений	Госстрой Украины	ДБН А.2.2-1-2003	15.12.2003
	Structure and content of materials of Environmental Impact Assessment (EIA) while designing and constructing enterprises, buildings and facilities	Gosstroy of Ukraine		
1.6.2	Охрана поверхностных вод от загрязнения	Главный государственный санитарный врач СССР	СанПиН 4630–88	04.07.1988
	Protection of surface waters from contamination	Surgeon General of USSR		
1.6.3	Державні санітарні правила планування та забудови населених пунктів. Зміна №1, 12.08.04 Зміна, 02.07.2007	МОЗ Украины	ДСП 173-96	19.06.1996
	State sanitary rules for planning and building of settlements. Alteration No.1, 12.08.04 Alteration, 02.07.2007	Ministry of Health of Ukraine		
1.6.4	Основні контрольні рівні, рівні звільнення та рівні дії щодо радіоактивного забруднення об'єктів зони відчуження	МНС України	ГН 6.6.1.076-001	28.09.2001

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Main Reference Levels, Releases and Activity Levels of Radiation Contamination of Exclusion Zone and the Zone of mandatory Resettlement	Ministry of Ukraine of Emergencies		
1.6.5	Правила радіаційної безпеки при проведенні робіт у зоні відчуження і зоні безумовного (обов’язкового) відселення	МОЗ и МНС України		04.04.2008
	Radiation safety rules for works in EZA and unconditional (mandatory) resettlement zone.	Ministry of Health of Ukraine and Ministry of Ukraine of Emergencies		
1.7 Строительные нормы и правила / 1.7 Construction codes and standards				
1.7.1	Об утверждении карты сейсмического микрорайонирования промплощадки ЧАЭС	Госстрой Украины		21.01.1998
	On approval of the seismic zoning map of the ChNPP industrial site	Gosstroy of Ukraine		
1.7.2	Основные нормативные требования и расчетные характеристики землетрясений для промплощадки Чернобыльской АЭС	Госстрой Украины		08.07.2005
	Main regulatory requirements and design characteristics for earthquakes performed for ChNPP industrial site	Gosstroy of Ukraine		
1.7.3	Проектування. Порядок розроблення, погодження, затвердження і склад проектної документації для об’єкта «Укриття»	Держбуд України	ВБН А.2.2-341.002.003.001-98	30.09.1998
	Design. Procedure of development, concurrence, approval and content of the design documentation for object Shelter	Gosstroy of Ukraine		
1.7.4	Сметная документация	Минтопенерго України	ВБН Д 1.1-342.0004-	2001

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	The budget documentation	Ministry of Fuel and Energy of Ukraine	001-01	
1.7.5	Защита от опасных геологических процессов. Строительство в сейсмических районах Украины	Міністерство регіонального розвитку та будівництва України	ДБН В.1.1-12:2006	2006
	Protection from hazardous geological processes. Construction in seismic regions of Ukraine	Minisrtry of Regional Development and Construction of Ukraine		
1.7.6	Строительная климатология и геофизика. Поправки - БСТ № 2; 10, 1994		СНиП 2.01.01-82	1982
	Construction climatology and geophysics. Amendments - BST No.2; 10, 1994			
1.7.7	Система обеспечения надежности и безопасности строительных объектов. Нагрузки и воздействия. Нормы проектирования. Изменение №1 - ИБ № 9, 2007; БИС № 4, 2007	Міністерство регіонального розвитку та будівництва України	ДБН В.1.2-2:2006	2006
	System for reliability and safety of construction objects. Loads and impacts. Design regulation. Alterations №1 - IB No.9, 2007; BIS No.4. 2007	Minisrtry of Regional Development and Construction of Ukraine		
1.7.8	Свайные фундаменты. Поправки - БСТ №3, 1987. Изменение №1 - БиС №4, 2001	Госстрой СССР	СНиП 2.02.03-85	1987
	Pile foundations. Amendments - BST No.3, 1987. Alterations №1 - Bis No.4, 2001	Gosstroy of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.7.9	Фундаменты машин с динамическими нагрузками	Госстрой СССР	СНиП 2.02.05-87	1987
	The bases of machines with dynamic loadings	Gosstroy of USSR		
1.7.10	Защита строительных конструкций от коррозии	Госстрой СССР	СНиП 2.03.11-85	1985
	Protection of structures against corrosion	Gosstroy of USSR		
1.7.11	Защита строительных конструкций и сооружений от коррозии	Госстрой СССР	СНиП 3.04.03-85	1988
	Corrosion protection of buildings and structures	Gosstroy of USSR		
1.7.12	Нормы проектирования. Стальные конструкции. Изменения №120 - 25.07.84, №218 - 11.12.85, №69 - 29.12.86, №132 - 08.07.88, №121 - 12.07.89	Госстрой СССР	СНиП II-23-81*	1990
	Norms of design. Steel structures. Alterations №120 - 25.07.84, №218 - 11.12.85, №69 - 29.12.86, №132 - 08.07.88, №121 - 12.07.89	Gosstroy of USSR		
1.7.13	Конструкции зданий и сооружений. Покрытия зданий и сооружений. Изменение №1 - БиС №1, 2000. Поправка - БиС № 1, 2000. Поправка - БиС № 3, 2002. Изменение №2 - БиС № 3, 2002 Изменение №3 - БиС № 1, 2005	Госстрой Украины	ДБН В.2.6-14-97	1997
	Building and structure's design. Structure's roofing. Alteration No.1 - BiS No.1, 2000. Amendment – BiS No.1, 2000. Amendment – BiS No.3, 2002. Alteration No.2 – BiS No.3, 2002.	Gosstroy of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Alteration No.3 – BiS No.1, 2005			
1.7.14	Геодезические работы в строительстве	Госкомитет СССР по делам строительства	СНиП 3.01.03-84	1997
	Geodesics work in construction	State Comm ittee of USSR on Building Affairs		
1.7.15	Несущие и ограждающие конструкции с изменениями. Разъяснение - БСТ № 10, 1988. Поправка - БСТ № 3, 1989. Изменение № 1, 1998	Госкомитет СССР по делам строительства	СНиП 3.03.01-87	1987
	Load bearing and fencing structures with changes. Explanation - BST No.10, 1988. Amendment - BST No.3, 1989. Alteration No.1, 1998	State Committee of USSR on Building Affairs		
1.7.16	Основания зданий и сооружений. Изменение №1 - БСТ № 5, 1986. Изменение №2 - БСТ № 9, 1987	Госстрой СССР	СНиП 2.02.01-83*	1985
	Foundations of buildings and facilities. Alteration No.1 - BST No.5, 1986. Alteration No.2 - BST No.9, 1987	Gosstroy of USSR		
1.7.17	Изыскания, проектирование и территориальная деятельность. Изыскания. Инженерные изыскания для строительства	Минрегионстрой Украины	ДБН А.2.1-1-2008	01.07.2008
	Investigations, design and territorial activity. Investigations. .Engineering survey for construction	Ministry of Regional Construction of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.7.18	Инженерная защита территорий, зданий и сооружений от опасных геологических процессов. Основные положения проектирования	Держбуд України	СНиП 2.01.15-90	1990
	Engineering protection of areas, structure against dangerous geological processes. Design general provisions	Gosstroy of Ukraine		
1.7.19	Технологическое оборудование и технологические трубопроводы	Госстрой СССР	СНиП 3.05.05-84	1996
	Processing equipment and industrial pipelines	Gosstroy of USSR		
1.7.20	Системы автоматизации. Изменение №1 - БСТ № 2, 1991	Госстрой СССР	СНиП 3.05.07-85	1985
	Automation systems. Alteration No.1 - BST No.2, 1991	Gosstroy of USSR		
1.7.21	Электротехнические устройства	Госкомитет СССР по делам строительства	СНиП 3.05.06-85	11.12.1985
	Electric technical facilities	State Committee of USSR for Construction		
1.7.22	Бетонные и железобетонные конструкции. Изменение - БСТ № 4, 1993. Изменение № 1 - БУ № 6, 1995; БУ № 1, 1996. Поправка - БУ № 3, 1996. Изменение № 2 , 1998	Госстрой СССР	СНиП 2.03.01-84*	20.08.1984
	Concrete and reinforced concrete structures. Alteration - BST No.4, 1993. Alteration No.1 - BU No.6, 1995; BU No.1, 1996. Amendment - BU No.3, 1996.	Gosstroy of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Alteration No.2, 1998			
1.7.23	Земляные сооружения, основания и фундаменты. Изменение № 1 - БиС №4, 2001	Госстрой СССР	СНиП 3.02.01-87	04.12.1987
	Earth structures, bases and foundations. Alteration No.1 - BiS No.4, 2001	Gosstroy of USSR		
1.7.24	Пособие по проектированию оснований зданий и сооружений. Изменение №1 - БСТ №5, 1986. Изменение №2 - БСТ №9, 1987	Госстрой СССР	СНиП 2.02.01-83	05.12.1985
	Foundations of buildings and facilities. The aid on designing. Alteration No.1 - BST No.5, 1986. Alteration No.2 - BST No.9, 1987	Gosstroy of USSR		
1.7.25	Пособие по проектированию железобетонных ростверков свайных фундаментов под колонны зданий и сооружений	Госстрой СССР	СНиП 2.03.01-84	20.08.1984
	Concrete and reinforced concrete structures. The aid on designing	Gosstroy of USSR		
1.7.26	Система обеспечения надежности и безопасности строительных объектов. Прогибы и перемещения. Требования к проектированию.	Міністерство регіонального розвитку та будівництва України	ДСТУ Б В.1.2-3:2006	2006
	System for Reliability and Safety of Construction Objects. Sagging and Displacements. Design Requirements	Minisrtry of Regional Development and Construction of Ukraine		
1.7.27	Пособие к СНиП 3.02.01-87 по производству работ при устройстве оснований и фундаментов	Госстрой СССР		1987

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Aid to СНиП 3.02.01-87 for work implementation for arrangement bases and foundations	Gosstroy of USSR		
1.7.28	Пособие к СНиП II-3-79. Расчет и проектирование ограждающих конструкций	Госстрой СССР		1979
	Aid to СНиП II-3-79 for calculation and designing of the fencing structures	Gosstroy of USSR		
1.7.29	Пособие к СНиП II-23-81* по проектированию стальных конструкций	Госстрой СССР		1981
	Aid to СНиП II-23-81*. Steel structures. The aid on designing	Gosstroy of USSR		
1.7.30	Пособие к СНиП II-23-81* по расчету и конструированию сварных соединений стальных конструкций	Госстрой СССР		1981
	Aid to СНиП II-23-81* for calculation and designing of the steel structures welded joints	Gosstroy of USSR		
1.7.31	Проектирование. Порядок разработки, согласование и утверждения проектной документации для строительства	Держбуд України	ДБН А 2.2-3-2004	20.01.2004
	Designing. The maintenance, the order of development, the coordination and the statement of the design documentation for construction	Gosstroy of Ukraine		
1.7.32	Управління, організація і технологія. Організація будівельного виробництва. Изменение № 1 - БиС № 4, 2005	Держбуд України	ДБН А.3.1-5-96	01.09.1996

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Management, organisation and technology. Construction industry organisation. Alteration No.1 – BiS No.4, 2005	Gosstroy of Ukraine		
1.7.33	Основні нормативні вимоги та розрахункові характеристики смерчів для майданчика Чорнобильської АЕС	Держбуд України	No 64	2002
	On basic normative requirements and design characteristics of tornadoes for Chernobyl NPP site	Gosstroy of Ukraine		
1.7.34	Технічній захист інформації. Загальні вимоги до організації проектування і проектної документації для будівництва. Організація будівельного виробництва. Изменение № 1 - БиС № 4, 2005	Держкоммістобудування України	ДБН А.2.2-2-96	02.09.1996
	Technical protection of information. General requirements to organization of designing and design documentation for construction. Organization of construction operations. Alteration No.1 – BiS No.4, 2005	State Committee of Ukraine on Bridge Engineering		
1.7.35	Сооружения промышленных предприятий. Поправки - БСТ № 3, 1987, БСТ № 10 и № 11, 1988. Изменение № 1- БиС № 1, 2005	Госстрой СССР	СНиП 2.09.03-85	29.12.1985
	Constructions of industrial enterprises. Amendments - BST No.3, 1987, BST No.10 and No.11, 1988. Alteration No.1- BiS No.1, 2005	Gosstroy of USSR		
1.7.36	Надежность строительных конструкций и оснований. Конструкции стальные. Основные положения по расчету	Госстрой СССР	СТ СЭВ 3972-83	20.07.1984

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Stability of building structures and foundations. Steel structures. General provisions by calculation	Gosstroy of USSR		
1.7.37	Конструкции бетонные и железобетонные. Основные положения проектирования	Госстрой СССР	СТ СЭВ 1406-78	12.1978
	Concrete and ferro-concrete structures. General provisions of designing	Gosstroy of USSR		
1.7.38	Защита от коррозии в строительстве. Конструкции бетонные и железобетонные. Классификация агрессивных сред	Госстрой СССР	СТ СЭВ 2440-80	07.1980
	Protection of corrosion at construction. Concrete and ferro-concrete structures. Classification of excited environments	Gosstroy of USSR		
1.7.39	Защита от коррозии в строительстве. Конструкции бетонные и железобетонные. Требования к первичной защите	Госстрой СССР	СТ СЭВ 4534-84	07.1984
	Protection of corrosion at construction. Concrete and ferro-concrete structures. Requirements to primary protection	Gosstroy of USSR		
1.7.40	Генеральные планы промышленных предприятий. Изменение (б/н) – БСТ № 4, 1985. Изменение (б/н) – БСТ № 7, 1986. Изменение №2 – БСТ № 3, 1987. Изменение №3 – БСТ № 11, 1990	Госстрой СССР	СНиП II-89-80	30.12.1980
	General layouts of industrial enterprises. Alteration – BST No.4, 1985. Alteration – BST No.7, 1986. Alteration No.2 – BST No.3, 1987. Alteration No.3 – BST No.11, 1990	Gosstroy of USSR		

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1	2	3	4	5
1.7.41	Производственные здания. Изменение №1, 2005 г.	Госстрой СССР	СНиП 2.09.02-85*	30.12.1985
	Production buildings. Alteration No.1, 2005	Gosstroy of USSR		
1.8. Стандарты по технической безопасности, охраны труда и пожарной безопасности / 1.8. Standarts for industrial, labor protection and fire safety				
1.8.1	Захист від пожежі. Будівельні конструкції. Методи випробувань на вогнестійкість. Загальні вимоги	Держкомітет будівництва, архітектури та житлової політики України	ДСТУ Б В.1.1-4-98*	28.10.1998
	Fire protection. Building structures. Methods of fire resistant testing. General requirements	State Committee for Construction, Architecture and Housing Policy of Ukraine		
1.8.2	Системи пожежної сигналізації. Частина 1. Вступ. (EN 54-1:1996, IDT). Системи пожежної сигналізації. Частина 11. Сповіщувачі пожежні ручні ((EN 54-11:1996, IDT)		ДСТУ EN 54-1:2003 ДСТУ EN 54-11:2004	01.07.1995
	Fire alarm systems. Part 1. Introduction (EN 54-1:1996, IDT). Fire alarm systems. Part 11. Manual fire alarms (EN 54-11:1996, IDT)			
1.8.3	Инженерное оборудование зданий и сооружений. Внешние сети и сооружения. Система газоснабжения. Газопроводы подземные и стальные. Общие требования к защите от коррозии	Мінбуд України	ДСТУ Б В.2.5-29:2006	22.12.2006
	Engineering equipment of buildings and facilities. Off-site utilites and facilities. Gas-supply system. Underground and steel gas pipelines . General requirements for protection against corrosion.	Ministry of Construction of Ukraine		

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1	2	3	4	5
1.8.4	Инженерное оборудование зданий и сооружений. Внешние сети и сооружения.. Трубопроводы стальные подземные систем холодного и горячего водоснабжения. Общие требования к защите от коррозии	Мінбуд України	ДСТУ Б В.2.5-30:2006	22.12.2006
	Engineering equipment of buildings and facilities. Off-site utilites and facilities. Gas-supply system. Underground and steel gas pipelines . General requirements for protection against corrosion.	Ministry of Construction of Ukraine		
1.8.5	Конструкції будинків і споруд. Теплова ізоляція будівель	Міністерство будівництва, архітектури та житлово-комунального господарства України	ДБН В.2.6-31:2006	09.09.2006
	Construction of buildings and facilities. Thermal building insulation	Ministry of Construction, Architecture, Housing and Utilities of Ukraine		
1.8.6	Ресурсные элементные сметные нормы на строительные конструкции. Дополнение 01.07.2002	Госстрой Украины	ДБН Д 11-1-2000	01.10.2000
	Resource elemental estimate norms for structures. Attachment, 01.07.2002	Gosstroy of Ukraine		
1.8.7	Административные и бытовые здания. Изменение № 1- БиС № 4, 2001. Изменение № 2 - БиС № 1, 2005. Поправка - БиС № 3, 2005	Госстрой СССР	СНиП 2.09.04-87*	30.12.1987
	Administration and domestic buildings.	Gosstroy of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Alteration No.1 - BiS No.4, 2001. Alteration No.2 – BiS No.1, 2005. Amendment – BiS No.3, 2005			
1.9 Стандарты по проектированию и строительству / 1.9 Standarts of designing and building				
1.9.1	Система сертифікації УкрСЕПРО. Процедура визнання результатів сертифікації продукції, що імпортується. Поправка - ИПС № 8, 1997. Изменение № 1- ИПС № 2, 2003. Изменение № 2 - ИПС № 10, 2006	Держстандарт України	ДСТУ 3417-96	01.04.1997
	Certification system of UkrSEPRO. Procedure for recognition of certification resultsof imported production. Amendment - IPS No.8, 1997. Alteration No.1- IPS №2, 2003. Alteration No.2 - IPS №10, 2006	State Committee for Standartization of Ukraine		
1.9.2	Обладнання для кондиціонування повітря та вентиляції. Вимоги до рівня надійності за критичними відмовами. Порядок та методи контролю показників надійності		ДСТУ 2915-94	1994
	Equipment for air conditioning and ventilation. Requirements for reliability level on critical requirements. Procedure and methods of reliability monitoring			
1.9.3	Обладнання для кондиціювання повітря та вентиляції. Загальні вимоги безпеки.	Держстандарт України	ДСТУ 3191-95 (ГОСТ 12.2.137-96)	1995
	Equipment for air conditioning and ventilation. General safety requirements	State Committee for Standarti-zation of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.9.4	Конструкції будинків і споруд. Автоматизовані системи технічного діагностування будівельних конструкцій. Види випробувань	Держкомітет будівництва, архітектури та житлової політики України	ДСТУ Б В.2.6-27:2006	04.05.2006
	Construction of buildings and facilities. Automated systems of building structures technical diagnostics. Types of tests	State Committee for Construction, Architecture and Housing Policy of Ukraine		
1.9.5	Конструкції будинків і споруд. Профілі сталеві гнуті замкнуті зварні квадратні і прямокутні для будівельних конструкцій. Технічні умови	Міждержавна науково-технічною комісія із стандартизації і технічного нормування в будівництві	ДСТУ Б В.2.6-8-95 (ГОСТ 30245-94)	06.04.1995
	Construction of buildings and facilities. Steel, bent, closed welded square and rectangular profiles for building structures. Technical specifications	International Scientific & Technical Commission on Codification in Construction		
1.9.6	Конструкції будинків і споруд. Вироби бетонні і залізобетонні. Загальні технічні умови. Изменение № 1- 1998	Держкоммістобудування України	ДСТУ Б В.2.6-2-95	06.04.1995
	Constructions of buildings and structures. Products of concrete and reinforced concrete. General technical requirements. Alteration No.1, 1998	State Committee of Ukraine on Bridge Engineering		
1.9.7	Розділові трансформатори і безпечні розділові трансформатори. Технічні умови. Поправка - ИПС № 7, 1999; № 11, 1999		ДСТУ 3225-95	1995

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Distribution transformers and safe distribution transformers. Technical specifications. Поправка - ИПС № 7, 1999; № 11, 1999			
1.9.8	Система проектної документації для будівництва. Правила виконання специфікації обладнання, виробів і матеріалів	Міждержавна науково-технічною комісія по стандартизації та технічному нормуванню в будівництві	ДСТУ Б А.2.4-10-95 (ГОСТ 21.110-95)	19.04.1995
	System of design documentation for construction. Rules for development of specifications of equipment, items and materials	International Scientific & Technical Commission on Codification in Construction		
1.9.9	Система стандартизації та нормування будівництві Грунти. Терміни і визначення	Міністерство України у справах будівництва та архітектури	ДСТУ Б А.1.1-25-94	12.04.1994
	System of standardisation and normalisation in construction. Grounds. Terms and definitions	Ministry of Ukraine for Construction and Architecture		
1.9.10	Основи та підвалини будинків і споруд. Грунти. Класифікація	Держкоммістобудування України	ДСТУ Б В.2.1-2-96 (ГОСТ 25100-95)	19.04.1995
	Bases and foundations of buildings and facilities. Grounds. Classifications	State Committee of Ukraine on Bridge Engineering		
1.9.11	Основи та підвалини будинків і споруд. Грунти. Польові випробування. Загальні положення	Держкомітет будівництва, архітектури та житлової політики України	ДСТУ Б В.2.1-6-2000 (ГОСТ 30672-99)	09.10.2000

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Bases and foundations of buildings and facilities. Grounds. Field tests. General provisions	State Committee for Construction, Architecture and Housing Policy of Ukraine		
1.9.12	Трубопроводи сталеві магістральні. Загальні вимоги до захисту від корозії. Поправка - ИПС № 4, 2004; № 10, 2005		ДСТУ 4219-2003	2003
	Main steel pipelines. General requirements for corrosion resistance. Amendment - IPS No.4, 2004; No.10, 2005			
1.9.13	Система проектної документаціЇ для будівництва. Основні вимоги до проектної и робочої документації. Поправка - БиС № 4, 2003	Держкомітет будівництва, архітектури та житлової політики України	ДСТУ Б А.2.4-4-99 (ГОСТ 21.101-97)	10.05.1999
	System of design documentation for construction. Basic requirements to design and working documentation. Amendment – BiS No.4, 2003	State Committee for Construction, Architecture and Housing Policy of Ukraine		
1.9.14	Защита от коррозии в строительстве. Конструкции бетонные и железобетонные. Требования к первичной защите	Держкомітет будівництва, архітектури та житлової політики України	СТ СЭВ 4534-84	07.1984
	Reliability of building constructions and foundations. Steel constructions. Main statements by calculation	State Committee for Construction, Architecture and Housing Policy of Ukraine		
1.9.15	Надёжность строительных конструкций и оснований. Основные положения по расчёту.	Госстрой СССР	ГОСТ 27751-88 (СТ СЭВ 384-87)	25.03.1988

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Изменение № 1- БУ № 5, 1996			
	Reliability of structures and bases. Main provisions for calculation. Alteration No.1- BU №5, 1996	Gosstroy USSR		
1.9.16	Конструкции металлические строительные. Общие технические условия	Госкомитет Совета Министров СССР по делам строительства	ГОСТ 23118-78	28.04.1978
	Metal construction structures. General technical conditions	Gosstroy USSR		
1.9.17	Система проектної документації для будівництва. Загальні положення	Держкоммістобудування України	ДСТУ Б А.2.4-5-95 (ГОСТ 21.001-93)	10.11.1993
	System of design documentation for construction. General regulations	State Committee of Ukraine on Bridge Engineering		
1.9.18	Состав и общие правила задания надежности	Госстандарт СССР	ГОСТ 27.003-90	01.01.1992
	Content and General Rules of Reliability Task	State Committee for Standartization of USSR		
1.10. Стандарты по АСУ ТП, средства коммуникации и технологического оборудования / 1.10 Standarts of ESS ASU, communications means and technological equipment				
1.10.1	Машины приборы и другие технические изделия. Исполнения для различных климатических районов. Категории, условия эксплуатации, хранения и транспортирования в части воздействия климатических факторов внешней среды. Изменение № 1 - ИУС № 3, 1978.	Государственный комитет СССР по стандартам	ГОСТ 15150-69	29.12.1969

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Изменение № 2 - ИУС № 4, 1983. Изменение № 3 - ИУС № 3, 1989. Изменение № 4 - ИПС № 8, 2002			
	Machines, devices and other technical products. Executions for various climatic areas. Categories, conditions of operation, storage and transportation regarding impact of environment climatic factors. Alteration No.1 - IUS №3, 1978. Alteration No.2 - IUS №4, 1983. Alteration No.3 - IUS №3, 1989. Alteration No.4 - IPS №8, 2002	State Committee for Standartization of USSR		
1.10.2	Автоматизированные системы контроля радиационной обстановки для атомных станций. Основные положения		ГСТУ 95.1.01.03.024-97	1997
	The automated monitoring systems of radiating conditions for nuclear stations. General provisions			
1.10.3	Надійність техніки. Аналіз надійності. Основні положення		ДСТУ 2861-94	1994
	Reliability of techniques. Analysis of reliability analysis. General provisions			
1.10.4	Надійність техніки. Методи розрахунків показників надійності. Загальні вимоги		ДСТУ 2862-94	1994
	Reliability of techniques. Methods for calculation of reliability parameters. General requirements			
1.10.5	Информационная технология. Виды испытаний автоматизированных систем	Государственный комитет СССР по стандартам	ГОСТ 34.603-92	01.01.1993

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Information technology. Types tests automated systems	State Committee for Standartization of USSR		
1.10.6	Средства измерения ионизирующих излучений. Общие технические условия	Госстандарт СССР	ГОСТ 27451-87*	23.10.1987
	Measuring means for ionizing radiation. General technical specifications	State Committee for Standartization of USSR		
1.11. Стандарты и нормы для проектирования кранов / 1.11 Standarts and norms for design of cranes				
1.11.1	ЄСКД. Експлуатаційні документи, 2006	Держстандарт України	ДСТУ ГОСТ 2.601:2006	01.07.2007
	ESKD. Operation documents, 2006	State Committee for Standartization of Ukraine		
1.11.2	ЄСКД. Правила виконання експлуатаційних документів	Держстандарт України	ДСТУ ГОСТ 2.610:2006	01.07.2007
	ESKD. Rules of operation documents performance	State Committee for Standartization of Ukraine		
1.11.3	Апарати та комплектні пристрої керування і захисту кранів, механізмів кранового типу. Загальні технічні умови		ДСТУ 3449-96 (ГОСТ 30463-97)	1996
	Devices and complete control facilities and protection of cranes, crane type mechanisms. General technical specifications			
1.11.4	Безпечність машин. Пристрої аварійної зупинки. Функціонування і принципи проектування	Держспоживстандарт України	ДСТУ EN 418:2003	2003
	Machine safety. Emergency shutdown devices. Working and design philosophy	State Committee of Ukraine for Technical Regulation and Consumer Policy		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.11.5	Безпечність машин. Звукові сигнали небезпеки. Загальні вимоги, проектування та випробування	Держстандарт України	ДСТУ EN 457:2001	2001
	Machine safety. Danger sound signals. General requirements, designing and tests	State Committee for Standartization of Ukraine		
1.11.6	Безпечність машин. Елементи безпечності систем керування. Частина 1 Загальні принципи проектування	Держспоживстандарт України	ДСТУ EN 954-1:2003	02.10.2003
	Machine safety. Safety elements of controlling systems. Part 1. General design philosophy	State Committee of Ukraine for Technical Regulation and Consumer Policy		
1.11.7	Безпечність машин. Системи звукових і візуальних сигналів небезпеки та попередження	Держстандарт України	ДСТУ EN 981:2001	29.08.2001
	Machine safety. Systems of sound and visible danger signals and warnings	State Committee for Standartization of Ukraine		
1.11.8	Безпечність машин. Вимоги безпеки до гідравлічних та пневматичних систем та їхніх складових частин. Гідравліка		ДСТУ EN 982:2003	2003
	Machine safety. Safety requirements to hydraulic and pneumatic systems and their components. Hydraulics			
1.11.9	Безпечність машин. Запобігання несподіваному пуску	Держспоживстандарт України	ДСТУ EN 1037:2003	02.10.2003
	Machine safety. Prevention of sudden starting	State Committee of Ukraine for Technical Regulation and Consumer Policy		
1.11.10	Вироби гарячекатані з нелегованих конструкційних сталей. Технічні умови постачання		ДСТУ EN 10025-1/6:2007	2007

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
	Hot-rolled products made from unalloyed construction steels. Technical specifications for delivery			
1.11.11	Безпечність машин. Технічні правила та вимоги до підіймально-транспортних засобів		ДСТУ pr EN 12937-2002	12.06.2002
	Machine safety. Technical rules and requirements to handling devices	Держспоживстандарт України		
1.11.12	Безпечність вантажопідіймальних кранів. Загальні положення конструювання. Частина 2. Вплив навантажень	State Committee of Ukraine for Technical Regulation and Consumer Policy	ДСТУ pr EN 13001-2-2001	2001
	Safety of lifting cranes. General provisions of engineering. Part 2. Loads influence			
1.11.13	Вантажопідіймальні крани. Пристрої вантажозахоплювальні знімні. Вимоги безпеки		ДСТУ pr EN 13155-2001	2001
	Lifting cranes. Demountable load-handling devices. Safety requirements			
1.11.14	Вантажопідіймальні крани. Органи керування та пости керування		ДСТУ EN 13557-2001	2001
	Lifting cranes. Regulatory bodies and command posts			
1.11.15	Безпечність машин. Електрообладнання машин. Частина 32. Вимоги до вантажопідіймальних машин		ДСТУ EN 60204-32:2006	2006
	Machine safety. Machines electric installation. Part 32. Requirements to lifting machines			
1.11.16	Безпечність машин. Стаціонарні засоби доступу до машин. Частина 3. Сходи, драбини зі східцями й перила	Держспоживстандарт України	ДСТУ ISO 14122-3:2004	2004 и др.

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1	2	3	4	5
	Machine safety. Permanent access to machines. Part 3. Steps, stairs with steps and railing	State Committee of Ukraine for Technical Regulation and Consumer Policy		
1.12. Документы ПОМ / 1.12. SIP Documents				
1.12.1	Роз’яснення до структури та змісту звіту з аналізу безпеки НБК	ДКЯРУ		03.05.2006
	Explanation to format and content of NSC safety analysis report	SNRC of Ukraine		
1.12.2	Роз’яснення до структури та змісту звіту про відповідність вимогам санітарного законодавства НБК	МОЗ України		20.03.2006
	Explanation to format and content of NSC compliance report with the requirements of state sanitary legislation	Ministry of Health of Ukraine		
1.12.3	Роз’яснення до структури та змісту оцінки впливів на навколишнє середовище НБК	Мінприроди України		20.03.2006
	Explanation to format and content of the assessment of NSC environmental impacts	Ministry of Environment of Ukraine		
1.12.4	Техническое решение об установлении квот по пределам «низкого» выброса из НБК	ГУП ПОМ	No20	18.04.2005
	Technical decision on establishing quotas for limits of “low” release from the NSC	SIP PMU		
1.12.5	Структура и требования к содержанию Документа по безопасности в рамках концепции проекта ПК-1 НБК	ГКЯРУ	SIP-P-SR-21-330-REC-117-02	2002
	Format and Requirements for content of safety document in the frame of NSC CS-1	SNRC of Ukraine		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.12.6	План лицензирования при реализации проектов ПОМ на объекте «Укрытие» ГСП Чернобыльская АЭС. Фаза 2	ГУП ПОМ		2003
	Licensing plan for realization of SIP projects at the Chernobyl NPP object Shelter. Phase 2	SIP PMU		
1.12.7	План лицензирования при реализации проекта нового безопасного конфайнмента (НБК) (Дополнение к Плану лицензирования при реализации проектов ПОМ на объекте «Укрытие» ГСП ЧАЭС. Фаза 2)	ГУП ПОМ		18.05.2005
	Licensing plan for realization of New Safe Confinement Project (NSC) (addendum to licensing plan for realization of SIP projects at the Chernobyl NPP object Shelter. Phase 2)	SIP PMU		
1.12.8	Проектные критерии и требования к НБК	ГУП ПОМ	SIP-P-TM-21-330-DC-101-01	31.10.2003
	NSC design criteria and requirements	SIP PMU		
1.12.9	Стратегия обращения с ТСМ и радиоактивными отходами объекта «Укрытия». План дальнейших действий	ГУП ПОМ	SIP-P-DI-19-120-STG-083-02	18.04.2005
	Strategy of OS FCM and RAW management. Further action plan	SIP PMU		
1.12.10	План мероприятий по повышению пожарной безопасности на ОУ	ГУП ПОМ	SIP-P-TM-16-235-TSN-017-01	16.09.2002
	Shelter fire safety improvement action plan	SIP PMU		
1.12.11	Стратегия дальнейшей реализации проекта НБК (ред. 2)	ГУП ПОМ	SIP-P-PM-21-330-EXN-004-01	23.04.2004
	Strategy of further NSC design implementation (rev. 2)	SIP PMU		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	2	3	4	5
1.12.12	Разъяснение технических требований относительно вспомогательных систем и объектов НБК (ред.3)	ГУП ПОМ	SIP-P-PM-22- 460-TSN-102-03	05.07.2006
	Technical requirements clarification for NSC auxiliary systems and facilities (rev. 3)	SIP PMU		
1.12.13	Программа обеспечения промышленной безопасности и охраны труда при реализации проектов ПОМ	ГУП ПОМ	SIP-P-SR-16-SOW-001-01	03.03.2003
	Industrial safety and health program for realization of projects under the SSE ChNPP SIP	SIP PMU		
1.12.14	Класифікація грунтів та інших матеріалів, які утворюються при виконанні земляних робіт під час реалізації плану здійснення заходів на ОУ	МОЗ України		29.10.2007
	Classification of soils and other materials originated from earth works under OS SIP realization	Ministry of Health of Ukraine		
1.12.15	Описание требований к проектированию	ГУП ПОМ	SIP-P-PM-22-046-SOW-052-009	2005
	Description of engineering requirements	SIP PMU		
1.12.16	ALARA анализ доз при строительстве (ред. А)	ГУП ПОМ	SA-305	30.05.2003
	Construction dose ALARA analysis (rev. A)	SIP PMU		
1.12.17	Схема вентиляционных каналов и выбросов от вентиляционных систем 3-го энергоблока и ОУ в ВТ-2	ГУП ПОМ	VS-104	2003
	Drawings of OS ventilation through the bypass	SIP PMU		
1.12.18	ТЭО. Концептуальный проект конфайнмента. Перечень дополнительных требований по результатам комплексной государственной экспертизы ТЭО (КП) НБК для учета на последующих стадиях проектирования	ГУП ПОМ	SIP-P-PM-21-330-EXN-005-01.TES	2004

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1	**2**	**3**	**4**	**5**
	FS. NSC conceptual design. List of the additional requirements based on the results of state comprehensive examination of NSC FS (CD) for utilization in the subsequent design stages.	SIP PMU		
1.12.19	Разъяснения классификации систем, конструкций компонентов ПК-1 НБК по влиянию на ядерную и радиационную безопасность	ГУП ПОМ	SIP-P-SM-21-330-REC-122-01	22.11.2006
	Clarifications to classification of systems, structures and components of the NSC CS-1 depending on their impact on nuclear and radiation safety	SIP PMU		
1.12.20	Техническое решение «Об утверждении проектных критериев ограничения силовых воздействий на строительные конструкции и основания объекта «Укрытие» в процессе строительства первого пускового комплекса НБК»	ГУП ПОМ		16.11.2007
	Technical decision “On approval of design criteria to limit power loads on the building structures and bases of the Shelter Object during the NSC first commision stage of construction”	SIP PMU		
1.12.21	Техническое решение об установлении исходных данных по выбросу пыли в атмосферу при авариях с разрушением защитного сооружения НБК	ЧАЭС	Инв. № 19	18.04.2005
	Technical decision “On Establishing input data for dust release into environment during accidents accompanied by NSC integrity breach”	ChNPP		

2. НПА и НД, рекомендуемые при разработке проекта ПК-1 НБК / 2. NLA and ND, recommended for CS-1 NSC project design

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
2.1 Нормы и правила по радиационной и ядерной безопасности, обращению с ядерными материалами и РАО /2.1. Codes and regulations for radiological and nuclear safety, nuclear materials and radwaste management				
2.1.1	Санитарные правила проектирования и эксплуатации атомных электростанций, с изменениями	МОЗ України	СП АС-88	1988
	Rules rules of the NPPs design and operation with changes	Ministry of Health of Ukraine		
2.1.2	Поводження з радіоактивними відходами. Контейнери для захоронення твердих радіоактивних відходів. Вимоги до забезпечення радіаційної безпеки	Мінекобезпеки України	НД 306.608-95	24.09.1996
	Radioactive waste management. Containers for disposal of solid radioactive waste. Requirements for radiation safety assurance	Ministry of Environmental Safety of Ukraine		
2.1.3	Основные правила ядерной безопасности при переработке, хранении и транспортировании ядерно-опасных делящихся материалов	Минатомэнерго СССР	ПБЯ 06-00-88	26.05.1988
	Main nuclear safety rules for processing storage and transportation of nuclear hazarodous fissionable materials	Ministry of Nuclear Energy of USSR		
2.1.4	Правила ядерной безопасности при хранении и транспортировке ядерно-опасных делящихся материалов	Минатомэнерго СССР	ПБЯ 06-09-90	04.02.1991
	Main nuclear safety rules for storage and transportation of nuclear hazarodous fissionable materials	Ministry of Nuclear Energy of USSR		
2.1.5	Порядок звільнення радіоактивних відходів і побічних радіоактивних матеріалів від регуляційного контролю	Мінекобезпеки України, МОЗ України	НП 306.3.04/2.002-97	17.11.1997

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1	3	4	5	6
	Procedure for regulatory exemption for radioactive waste and side radioactive materials	Ministry of Environment of Ukraine, Ministry of Health of Ukraine		
2.1.6	Обеспечение безопасности. Санитарные правила радиационной безопасности при выполнении и проектировании работ на объекте «Укрытие» (СПРБ-ОУ)	МОЗ України	СТП 3.014-2004	2004
	Safety assurance. Sanitary rules of radiation safety during execution and engineering of works at object Shelter (СПРБ-ОУ)	Ministry of Health of Ukraine		
2.1.7	Загальні положення безпеки атомних станцій	ДКЯРУ	НП 306.2.141-2008	19.11.2007
	General provisions on nuclear power plant safety assurance	SNRC of Ukraine		
2.1.8	Вимоги з ядерної та радіаційної безпеки до інформаційних і керуючих систем, важливих для безпеки атомних станцій	ДКЯРУ	НП 306.5.02/3.035-2000	28.03.2000
	Nuclear and radiation safety requirements for information and control systems important for safety of power plants	SNRC of Ukraine		
2..1.9	Санитарные правила обращения с радиоактивными отходами	МОЗ СССР	СПОРО-85	01.10.1985
	Sanitary rules for radioactive waste management	Ministry of Health of USSR		
2.1.10	Техническое решение «Об оценке рисков отказов строительных конструкций и основания объекта «Укрытие» в процессе подготовительных работ, при «надвижке» Арки НБК и её размещении в проектном положении»	ГУП ПОМ		2007
	Technical decision “On assessment the failure risks of building structures and foundation of the Object Shelter in the course of preliminary works, under sliding of NSC Arch and its placement in the designed position”	SIP PMU		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	**3**	**4**	**5**	**6**
2.1.11	Оборудование и трубопроводы атомных энергетических установок. Сварные соединения и наплавки. Правила контроля	Госатомэнергонадзор СССР	ПНАЭ Г-7-010-89	11.05.1989
	Equipment and pipelines of nuclear power facilities. Welded joints and overlaying. Rules of control	USSR State Atom Inspectorate		
2.1.12	Оборудование и трубопроводы атомных энергетических установок. Сварка и наплавка. Основные положения	Госатомэнергонадзор СССР	ПНАЭ Г-7-009-89	11.05.1989
	Equipment and pipelines of nuclear power facilities. Welding and overlaying. Basic provisions	USSR State Atom Inspectorate		
2.2 Правила и нормы технической безопасности, охраны труда и пожарной безопасности / 2.2. Codes and regulations for industrial, labor protection and fire safety				
2.2.1	Техника безопасности в строительстве. Разъяснение - БСТ № 7, 1990	Госстрой СССР	СНиП III-4-80*	09.06.1980
	Safety measures for construction. Explanation - BST No.7, 1990	Gosstroy of USSR		
2.2.2	Державні стандартні норми виробничої загальної та локальної вібрації	МОЗ України	ДСН 3.3.6.039-99	01.12.1999
	State sanitary norms for industrial common and local vibration	Ministry of Health of Ukraine		
2.2.3	Санітарні норми мікроклімату виробничих приміщень	МОЗ України	ДСН 3.3.6.042-99	01.12.1999
	Sanitary norms for industrial rooms microclimate	Ministry of Health of Ukraine		
2.2.4	Порядок ідентифікації та обліку об'єктів підвищеної небезпеки	Кабінет Міністрів України	НПАОП 0.00-6.21-02	01.10.2002.
	Order of identification and registration as regard the object of high risk	Cabinet of Ministers of Ukraine		

№ п/п /No.	**Название документа / Document Title**	**Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document**	**Номер документа/ Document Reference**	**Дата/Date**
1	**3**	**4**	**5**	**6**
2.2.5	Правила захисту від статичної електрики	Держнаглядохоронпраці України	НПАОП 0.00-1.29-97	22.04.1997
	Rules for protection against static electricity effect	Inspectorate of Labour Protection of Ukraine		
2.2.6	Положення щодо розробки планів локалізації та ліквідації аварійних ситуацій і аварій	Держнаглядохоронпраці України	НПАОП 0.00-4.33-99	17.06.1999
	Provisions for localization plans and elimination of the emergencies and accidents	Inspectorate of Labour Protection of Ukraine		
2.2.7	Перелік робіт з підвищеною небезпекою	Держнаглядохоронпраці України	НПАОП 0.00-8.24-05	26.01.2005
	List of jobs with high risk	Inspectorate of Labour Protection of Ukraine		
2.2.8	Нормативи порогових мас небезпечних речовин для ідентифікації об'єктів підвищеної небезпеки	Кабінет Міністрів України	НПАОП 0.00-3.08-02	01.10.2002
	Norms of threshold masses for hazardous substances to identify the objects of high risk	Cabinet of Ministers of Ukraine		
2.2.9	Правила безопасности систем газоснабжения Украины.	Держнаглядохоронпраці України	НПАОП 0.00-1.20-98	01.10.1998
	Safety rules for gas supply system of Ukraine	Inspectorate of Labour Protection of Ukraine		
2.2.10	Правила по охране труда во время выполнения работ на высоте			27.03.2007
	Safety rules for working at heights			

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
2.2.11	Инструкция по охране труда при выполнении работ на высоте с использованием специальных страховочных средств	Держнаглядохоронпраці України	НПАОП 0.00-5.28-03	09.10.2003
	Labour protection instruction for work implementation at the height utilizing the special safety assurance means	Inspectorate of Labour Protection of Ukraine		
2.2.12	Типова інструкція з безпечного ведення робіт для кранівників (машиністів) стрілових самохідних (автомобільних, гусеничних, залізничних, пневмоколісних) кранів	Держнаглядохоронпраці України	НПАОП 0.00-5.26-01	25.09.1995
	Instruction of safe work operation for hoisters (crane-operators) of switch laying mobile cranes (motor- transport, tractor, railway, pneumowheel)	Inspectorate of Labour Protection of Ukraine		
2.2.13	Типовая инструкция по безопасному ведению работ для стропальщиков (зацепщиков), обслуживающих грузоподъемные краны	Держнаглядохоронпраці України	НПАОП 0.00-5.04-95	25.09.1995
	Instruction for safe work management for strappers (second loader), servicing the climbing cranes	Inspectorate of Labour Protection of Ukraine		
2.2.14	Типова інструкція з безпечного ведення робіт для кранівників (машиністів) баштових кранів	Держнаглядохоронпраці України	НПАОП 0.00-5.05-95	14.11.1995
	Instruction for safe management for hoisters (crane-operators) of tower cranes	Inspectorate of Labour Protection of Ukraine		
2.2.15	Типова інструкція для осіб, відповідальних за безпечне проведення робіт з переміщення вантажів кранами	Держнаглядохоронпраці України	НПАОП 0.00-5.06-94	20.10.1994
	Instruction for persons, responsible for safe management of works addressed to loads displacement with cranes	Inspectorate of Labour Protection of Ukraine		
2.2.16	Типовая инструкция для лиц, ответственных за содержание грузоподъемных кранов в исправном состоянии	Держнаглядохоронпраці України	НПАОП 0.00-5.07-94	20.10.1994

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
	Instruction for persons, responsible for keeping the cranes in working order	Inspectorate of Labour Protection of Ukraine		
2.2.17	Типова інструкція з безпечного ведення робіт для кранівників (машиністів) кранів мостового типу (мостових, козлових, напівкозлових)	Держнаглядохоронпраці України	НПАОП 0.00-5.18-96	20.03.1996
	Instruction of safe work management for hoisters (crane-operators) of bridge type cranes (bridge, gantry, half-gantly)	Inspectorate of Labour Protection of Ukraine		
2.2.18	Типова інструкція для інженерно-технічних працівників, які здійснюють нагляд за утриманням та безпечною експлуатацією вантажопідіймальних кранів	Держнаглядохоронпраці України	НПАОП 0.00-5.20-94	20.10.1994
	Instruction for engineering personnel, keeping supervision over safe operation of load-lifting crane	Inspectorate of Labour Protection of Ukraine		
2.2.19	Інструкція з безпечного виконання зварювальних робіт в електромонтажному виробництві	Мінпраці України	НПАОП 0.00-5.23-01	05.06.2001
	Instruction for safe performance of welding works in wiring production.	Ministry of Labour of Ukraine		
2.2.20	Інструкція з охорони праці під час виконання монтажних робіт інструментами і пристроями	Мінпраці України	НПАОП 0.00-5.24-01	05.06.2001
	Instruction for safe labor during installation works implementation utilizing the tools and devices.	Ministry of Labour of Ukraine		
2.2.21	Єдина державна система показників обліку умов та безпеки праці	Держнаглядохоронпраці України	НПАОП 0.00-8.05-94	31.03.1994
	Unified state system of safety and conditions of work registration indicators	Inspectorate of Labour Protection of Ukraine		
2.2.22	Порядок декларування безпеки об’єктів підвищеної небезпеки	Кабінет Міністрів України	НПАОП 0.00-8.22-02	01.10.2002
	Order of avowal for objects with high safety risk	Cabinet of Ministers of		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
		Ukraine		
2.2.23	Порядок ведения учета данных о техническом состоянии машин, механизмов, оборудования повышенной опасности	Держнаглядохоронпраці України	НПАОП 0.00-6.07-04	06.12.2004
	Order of registration the data on technical status of machinery and equipment with high safety risk	Inspectorate of Labour Protection of Ukraine		
2.2.24	Положення про медичний огляд працівників певних категорій	МОЗ України	ДНАОП 0.03-4.02-94	31.03.1994
	Provisions of medical care for workers of proper categories	Ministry of Health of Ukraine		
2.2.25	Порядок розслідування та ведення обліку нещасних випадків, професійних захворювань і аварій на виробництві	Держнаглядохоронпраці України	НПАОП 0.00-4.03-04	08.06.2004
	Order of investigation for accidents, occupational disease, and accident at work	Inspectorate of Labour Protection of Ukraine		
2.2.26	Правила технического содержания установок пожарной автоматики	МНС України	НАПБ Б.01.004-2000	29.08.2000
	Maintenance rules for the fire automatic units	Ministry of Internal Affairs		
2.2.27	Ліцензійні умови провадження господарської діяльності з проектування, монтажу, технічного обслуговування засобів протипожежного захисту та систем опалення, оцінки протипожежного стану об’єктів	Держпідриємництва та Держпожбезпеки МНС України	НАПБ Б.07.016-2004	01.09.2004
	License terms of economic activity implementation on design, installation, maintenance, methods of fire protection and heating systems, evaluation of fire protection state of objects	MESU Committees on State Business and Fire Safety		

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1	3	4	5	6
2.2.28	Ліцензійні умови провадження господарської діяльності з проведення випробувань на пожежну безпеку речовин, матеріалів, будівельних конструкцій, виробів і обладнання, а також пожежної техніки, пожежно-технічного озброєння, продукції протипожежного призначення на відповідність встановленим вимогам	Держкомітет України з питань регуляторної політики та підприємництва, МНС України	НАПБ Б.07.017-2004	01.09.2004
	License terms of economic activity implementation of trial on fire safety of substances, materials, building structures, articles and equipment as well as fire equipment, fire fitting, fire preventive products on conformity to requirements	MESU Committees on State Business and Fire Safety		
2.2.29	Положення про Державну пожежну охорону	Кабинет Министров Украины	НАПБ Б.02.001-94	26.07.1994
	State fire protection provisions	Cabinet of Ministers of Ukraine		
2.2.30	Типова інструкція з організації безпечного ведення вогневих робіт на вибухонебезпечних і вибухопожежонебезпечних об’єктах	Мінпраці України	ДНАОП 0.00-5.12-01	06.06.2001
	Instructions for safe performance of hot works at explosion and fire hazardous facilities	Ministry of Labour of Ukraine		
2.2.31	Перечень однотипных по назначению объектов, которые подлежат оборудованию автоматическими установками пожаротушения и пожарной сигнализацией	МНС України	НАПБ Б.06.004-2005	22.08.2005
	List of similar facilities subject to equipping with automatic fire fighting installations and fire alarm	Ministry of Ukraine of Emergencies		
2.2.32	Технологическая инструкция. Порядок устройства, монтажа средств систем оповещения о пожаре	Добровільне пожежне товариство України	НАПБ 05.012-91	27.06.1991

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1	3	4	5	6
	Technological instruction. Procedure for set-up and installation of fire alert systems	Voluntary Fireproof Association of Ukraine		
2.2.33	Положення про порядок погодження з органами державного пожежного нагляду проектних рішень, на які не встановлено норми та правила, обгрунтованих відхилень від обов'язкових вимог нормативних документів	МНС України	НАПБ Б.02.014-2004	15.11.2004
	Provisions on approval of the design solutions by the state fire supervision for which codes and standards are not established, as well as approval of the justified deviations from mandatory requirements of the normative documents	Ministry of Ukraine of Emergencies		
2.2.34	Правила обов’язкової сертифікації продукції протипожежного призначення	Мінпаливенерго України	НАПБ Б.01.003-97	27.06.1997
	Rules for obligatory certification of fire-proof products	Ministry of Fuel and Energy of Ukraine		
2.2.35	Положение о порядке государственного пожарного надзора за строительством объектов иностранными фирмами	МНС України	НАПБ Б.02.015-2004	05.07.2004
	Provisions on the state fire supervision of facility construction by foreign companies	Ministry of Ukraine of Emergencies		
2.2.36	Інструкція з пожежної безпеки та захисту автоматичними установками водяного пожежогасіння кабельних споруд	Мінпаливенерго України	НАПБ 05.031-2001	08.11.2001
	Instruction for fire safety and protection of cable installation by automatic systems of water fire fighting	Ministry of Fuel and Energy of Ukraine		
2.2.37	Типова інструкція з експлуатації автоматичних установок пожежної сигналізації	Мінпаливенерго України	НАПБ 05.024-2000	07.06.2000

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1	**3**	**4**	**5**	**6**
	Instruction for operation of automatic fire alarm system	Ministry of Fuel and Energy of Ukraine		
2.2.38	Типова інструкція з експлуатації автоматичних установок пожежогасіння	Мінпаливенерго України	НАПБ 05.025-2000	12.06.2000
	Instruction for operation of automatic fire extinguishing facilities	Ministry of Fuel and Energy of Ukraine		
2.2.39	Інструкція з протипожежного захисту розподільних пристроїв, підстанцій та трансформаторів	Мінпаливенерго України	НАПБ 05.032-2002	28.01.2002
	Fire protection instruction for distribution facilities of the substations and transformers	Ministry of Fuel and Energy of Ukraine		
2.2.40	Типовая инструкция по содержанию и применению первичных средств пожаротушения на предприятиях Минтопэнерго Украины	Мінпаливенерго України	НАПБ 05.026-2000	10.07.2000
	Instruction for maintenance and application of primary fire extinguishing means at enterprises of Minpalivenergo of Ukraine	Ministry of Fuel and Energy of Ukraine		
2.2.41	Типові норми належності вогнегасників	МНС України	НАПБ Б. 03.001-2004	02.04.2004
	Norms for availability of fire extinguishers	Ministry of Ukraine of Emergencies		
2.2.42	Правила будови електроустановок. Протипожежний захист електроустановок	Мінпаливенерго України	НАПБ В. 01.056-2005	11.05.2005
	Rules for construction of the electric installation. Fire protection of the electric installations	Ministry of Fuel and Energy of Ukraine		

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1	3	4	5	6
2.2.43	Інструкція щодо застосування вогнезахисних покриттів для кабелів у кабельних спорудах	Мінпаливенерго України	НАПБ В. 05.023-2005/111	01.04.2005
	Instruction of utilization the fire protective coverings for cables in cable facilities	Ministry of Fuel and Energy of Ukraine		
2.2.44	Методика проведення державної експертизи (перевірки) проектної документації на будівництво (реконструкцію, технічне переоснащення) виробничих об’єктів і виготовлення засобів виробництва на відповідність їх нормативним актам про охорону праці	Держнаглядохоронпраці України	ДНАОП 0.00-6.03-94	30.09.1994
	Method for state expert review of design documents for construction and reconstruction of production facilities and fabrication of production means against health and safety norms	Inspectorate of Labour Protection of Ukraine		
2.2.45	Типова інструкція з організації безпечного ведення газонебезпечних робіт	Держгіртехнагляд СРСР	ДНАОП 0.00-5.11-85	20.02.1985
	Instructions for safe performance of gas hazard works	USSR State Mining Inspectorate		
2.2.46	Інженерне обладнання будинків і споруд. Проектування електрообладнання об'єктів цивільного призначення	Держбуд України	ДБН В.2.5-23-2003	08.09.2003
	Engineering equipment for buildings, structures and facilities. Designing of an electric equipment of objects of civil purpose	Gosstroy of Ukraine		
2.2.47	Безпека АЕС. Положення про порядок розслідування та обліку порушень в роботі атомних електричних станцій	ДКЯРУ	НП 306.2.100-2004	01.12.2004
	Safety NPP. Provisions for investigation and record of faults in operation of nuclear power plants	SNRC of Ukraine		
2.2.48	Правила радиационной безопасности при эксплуатации атомных станций	Минздрав СССР	ПРБ АС – 89	11.06.1989

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1	**3**	**4**	**5**	**6**
	Radioactive safety rules for operation of nuclear power plant	Ministry of Health USSR		
2.2.49	Инструкция по разработке проектов производства работ по монтажу строительных конструкций	Минтрансстрой СССР	ВСН 193-81	01.10.1981
	Instruction on development of work execution plans for erection of structures	Mintransstroy USSR		
2.2.50	Правила пожарной безопасности при проведении строительно-монтажных работ на объектах Минэнерго СССР	Минэнерго Украины	НАПБ 01.021.88.	27.10.1988
	Fire safety rules for construction and erection activities at the facilities of the Ministry of energy of USSR	Ministry of Energy of Ukraine		
2.2.51	Перечень помещений и зданий энергетических предприятий Минэнерго Украины с указанием категорий и классификацией зон по взрывопожарной опасности	Минэнерго Украины	НАПБ 06.015-2006	13.09.2006
	List of power enterprise rooms and buildings of the Ministry of Energy of Ukraine with indication of categories and classifications by fire and explosion hazard	Ministry of Energy of Ukraine		
2.2.52	Управление поставками продукции. Исходные требования к импортному оборудованию, важному для безопасности ядерных установок и объектов, предназначенных для обращения с радиоактивными отходами. Порядок разработки, построения, согласования и утверждения исходных требований на поставку		СТП 0.08.003-99	1999

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1	3	4	5	6
	Product procurement management. Input requirements for imported equipment important for safety of nuclear installations and facilities designed for radioactive waste management. Procedure for development, establishment, concurrence and approval of input requirements for procurement			
2.2.53	Правила устройства и безопасной эксплуатации оборудования и трубопроводов атомных энергетических установок	Готсатомнадзор СССР	ПНАЭ Г-7-008-89	01.01.1990
	Rules for set-up and safe operation of equipment of pipelines of nuclear power facilities	USSR State Atom Inspectorate		
2.2.54	Правила устройства и эксплуатации локализующих систем безопасности атомных станций	Госатомэнергонадзор СССР	ПНАЭ Г-10-021-90	04.05.1990
	Rules for set-up and operation of nuclear plants localization safety systems	USSR State Atom Inspectorate		
2.2.55	Автоматизированные системы. Требования к содержанию документов	Госстандарт СССР	РД 50-34.698-90	01.01.1992
	Automated systems. Requirements for content of documents	State Committee for Standartization of USSR		
2.2.56	Пожежна безпека. Терміни та визначення основних понять	Держстандарт України	ДСТУ 2272:2006	09.06.2006
	Fire safety. Terms and definitions	State Committee for Standartization of Ukraine		
2.2.57	Пожежна техніка. Терміни та визначення	Держстандарт України	ДСТУ 2273:2006	09.06.2006
	Fire engineering. Terms and definitions	State Committee for Standartization of Ukraine		

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1	**3**	**4**	**5**	**6**
2.2.58	Взрывобезопасность. Общие требования Изменение №1- ИУС №6, 1983	Госкомитет Совета Министров СССР	ГОСТ 12.1.010-76* (СТ СЭВ 3517-81)	01.07.1978
	Explosion safety. General requirements. Alteration No.1- IUS №6, 1983	State Committee of the Counsil of Ministers of the USSR		
2.2.59	Пожарная техника для защиты объектов. Основные виды. Размещение и обслуживание Изменение №1 - ИУС №10, 1989	Госкомитет Совета Министров СССР	ГОСТ 12.4.009-83	01.01.1985
	Fire fighting equipment for protection of units. Basic types. Location and maintenance. Alteration No.1 - IUS №10, 1989	State Committee of the Counsil of Ministers of the USSR		
2.2.60	Пожарная безопасность. Общие требования. Изменение №1 - ИУС №1, 1995	Госкомитет Совета Министров СССР	ГОСТ 12.1.004-91	01.07.1991
	Fire safety. General requirements. Alteration No.1 - IUS №1, 1995	State Committee of the Counsil of Ministers of the USSR		
2.2.61	Правила аттестации сварщиков	Держнаглядохоронпраці України	НПАОП 0.00-1.16-96	19.04.1996
	Rules for certification of welders	Inspectorate of Labour Protection of Ukraine		
2.3. Документы по обеспечению качества и сертификации / 2.3. Documents on quality assurance and certification				
2.3.1	Система управління якістю. Вимоги	Держстандарт України	ДСТУ ISO 9001-2001	01.10.2001
	Quality management systems. Requirements	State Committee for Standartization of Ukraine		

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1	**3**	**4**	**5**	**6**
2.3.2	Вимоги до програми забезпечення якості на всіх етапах життєвого циклу ядерних установок	Мінекобезпеки України	НП 306.5.02/3.017-99	11.03.1999
	Requirements for quality assurance program at all stages of nuclear facility life cycle	Ministry of Environmental Safety of Ukraine		
2.3.3	Система сертифікації УкрСЕПРО. Основні положення Поправки - ИПС № 8, 1997; № 5, 2000. Изменение № 1- № 8, 2000. Изменение № 2 - ИПС № 11, 2000. Изменение № 3 - ИПС № 2, 2003	Держстандарт України	ДСТУ 3410-96	1996
	UkrSERPO Certification system. Basic regulations Amendments - IPS No.8, 1997; No.5, 2000 Alteration No.1- No.8, 2000 Alteration No.2 - IPS No.11, 2000 Alteration No.3 - IPS No.2, 2003	State Committee for Standartization of Ukraine		
2.3.4	Система сертифікації УкрСЕПРО. Сертифікація систем якості. Порядок проведення Поправки - ИПС № 8, 1997; № 8, 1999; № 5, 2000. Изменение № 1 - № 7, 2000. Изменение № 2 - ИПС № 2, 2003	Держстандарт України	ДСТУ 3419-96	1996
	Certification system of UkrSEPRO. Certification of quality systems Amendments - IPS No.8, 1997; No.8, 1999; No.5, 2000. Alterations No.1 - No.7, 2000 Alterations No.2 - IPS No.2, 2003	State Committee for Standartization of Ukraine		
2.3.5	Вимоги щодо структури та змісту звіту з аналізу безпеки реалізації проектів плану здійснення заходів на об□єкті «Укриття»	ДКЯРУ	НП 306.5.04/3.054-2001	03.12.2001

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	**3**	**4**	**5**	**6**
	Requirements to structure and content of safety analysis report on Shelter implementation plan projects	SNRC of Ukraine		
2.3.6	Ліцензія на право здійснення виду діяльності експлуатації об'єкту «Укриття»	ДКЯРУ	ЕО 000033	12.2001
	License for the right to implement operation of object Shelter	SNRC of Ukraine		
2.4. Стандарты по технической безопасности, охраны труда и пожарной безопасности ⁄ 2.4. Standarts for industrial, labor protection and fire safety				
2.4.1	Смеси взрывоопасные. Классификация и методы испытаний Изменение № 1- ИУС № 5, 1982. Изменение № 2 - ИУС № 10, 1988	Госкомитет Совета Министров СССР	ГОСТ 12.1.011-78* (СТ СЭВ 2775-80)	01.07.1979
	Explosive mixtures. Classification and test methods. Alterations No. No 1- IUS No 5, 1982. Alterations No.2 - IUS No 10, 1988	USSR Council of Ministers State Committee		
2.4.2	Пожарная техника. Классификация пожаров	Госкомитет Совета Министров СССР	ГОСТ 27331-87	01.01.1988
	Fire engineering. Classification of fire	USSR Council of Ministers State Committee		
2.4.3	Установки пожаротушения автоматические. Общие технические требования	Госкомитет Совета Министров СССР	ГОСТ 12.3.046-91	01.01.1993
	Automatic fire fighting systems. General technical requirements	USSR Council of Ministers State Committee		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
2.4.4	Цвета сигнальные и знаки безопасности Изменение № 1 - ИУС № 12, 1980. Изменение № 2 - ИУС № 10, 1986	Госкомитет Совета Министров СССР	ГОСТ 12.4.026-76	01.01.1978
	Signal colours and safety signs. Alterations No.1 - IUS No.12, 1980. Alterations No.2 - IUS No.10, 1986	USSR Council of Ministers State Committee		
2.5 Стандарты по проектированию и строительству ⁄ 2.5 Standarts of designing and building				
2.5.1	Система проектной документации для строительства (СПДС). Отопление, вентиляция и кондиционирование воздуха. Рабочие чертежи. Изменение № 1 - ИУС № 1, 1981	Госкомитет Совета Министров СССР	ГОСТ 21.602-79 (СТ СЭВ 3216-81)	01.01.1981
	Heating, ventilation and air conditioning. Working drawings. Alteration No.1 - IUS №1, 1981	USSR Council of Ministers State Committee		
2.5.2	Средства измерений ионизирующих излучений. Общие технические условия Изменение № 1 - ИУС № 6, 1989. Изменение № 2 - ИУС № 6, 1995	Госстандарт СССР	ГОСТ 27451-87	01.01.1989
	Measuring means for ionizing radiation. General technical specifications. Alteration No.1 - IUS No.6, 1989. Alteration No.2 - IUS No.6, 1995	State Committee for Standartization of USSR		
2.5.3	Единая система стандартов автоматизированных систем управления. Надежность автоматизирвоанных систем управления. Общие требования	Госкомитет Совета Министров СССР	ГОСТ 24.701-86	01.01.1982

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1	3	4	5	6
	Unified system of automated control system standartization. Reliability of automated control system. Major provisions.	USSR Council of Ministers State Committee		
2.5.4	Информационная технология. Комплекс стандартов на автоматизированные системы. Автоматизированные системы. Стадии создания.	Госстандарт СССР	ГОСТ 34.601-90	01.01.1992
	Information technology. System of standards on automated systems. Automated systems. Stages of development	State Committee for Standartization of USSR		
2.5.5	Информационная технология. Комплекс стандартов на автоматизированные системы. Виды, комплектность и обозначения документов при создании автоматизироанных систем. Изменение №1- ИУС №4, 1991	Госстандарт СССР	ГОСТ 34.201-89	01.01.1990
	Information technology. Package of standards for computer-based systems. Types, completeness and identification of documents at creation of these systems. Alteration No.1- IUS No.4, 1991	State Committee for Standart-ization of USSR		
2.5.6	Изделия ГСП. Общие технические условия Изменение № 1 - ИУС № 1, 1989. Изменение № 2 - ИУС № 5, 1990. Изменение № 3 - ИУС № 4, 1991 Изменение № 4 - ИУС № 1, 1993	Госстандарт СССР	ГОСТ 12997-84	1984
	SSE Products. General specifications. Alteration No.1 - IUS No.1, 1989. Alteration No.2 - IUS No.5, 1990. Alteration No.3 - IUS No.4, 1991 Alteration No.4 - IUS No.1, 1993	State Committee for Standartization of USSR		

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1	**3**	**4**	**5**	**6**
2.5.7	Надійність техніки. Терміни та визначення	Держстандарт України	ДСТУ 2860-94	1994
	Reliability of techniques. Terms and definitions	State Committee for Standartization of Ukraine		
2.5.8	Надійність техніки. Програма забезпечення надійності. Загальні вимоги	Держстандарт України	ДСТУ 2863-94	1994
	Reliability of techniques. Programme of assuring reliability. General requirements	State Committee for Standartization of Ukraine		
2.5.9	Надійність техніки. Методи оцінки показників надійності за експериментальними даними	Держстандарт України	ДСТУ 3004-95	1995
	Reliability of techniques. Methods of assessment of parameters of reliability with experimental data	State Committee for Standartization of Ukraine		
2.5.10	Засоби радіоелектронні. Надійність резервованих систем. Загальні положення	Держстандарт України	ДСТУ 2566-94	01.07.1995
	Radio-electronic means. Reliability of reserved systems. General provisions	State Committee for Standartization of Ukraine		
2.5.11	Аппаратура контроля радиационной обстановки. Общие требования	Госстандарт СССР	ГОСТ 29074-91	01.07.1992
	Devices of radiation condition monitoring. General requirements	State Committee for Standartization of USSR		
2.5.12	Единая система стандартов автоматизированных систем управления. Автоматизированные системы управления. Общие требования	Госстандарт СССР	ГОСТ 24.104-85	01.01 1987
	Uniform package of standards for computer-based systems. Reliability of automated control systems. General requirements	State Committee for Standartization of USSR		

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2.5.13	Метрология. Нормируемые метрологические характеристики средств измерений Поправка - ИПС № 8, 1996	Госстандарт СССР	ГОСТ 8.009-84	01.01.1986
	Metrology. Normalized metrological characteristics of measurement means. Amendment - IPS No.8, 1996	State Committee for Standartization of USSR		
2.5.14	Автоматизовані системи керування технологічними Программа. Метрологічне забезпечення. Основні положення	Держстандарт України	ДСТУ 2709-94	1994
	Automated control systems of technological processes. Metrological support. General provisions	State Committee for Standartization of Ukraine		
2.5.15	Метрологія. Метрологічна атестація засобів вимірювальної техніки. Організація та порядок проведення Поправка - ИПС № 12, 1995; ИПС № 8, 1996. Изменение № 1 - ИПС № 12, 1999. Изменение № 2 - ИПС № 10, 2007	Держстандарт України	ДСТУ 3215-95	1995
	Metrology. Metrological certification of meawuring techniques means. Organization, order and consideration. Amendment - IPS No.12, 1995; IPS No.8, 1996. Alteration No.1 - IPS No.12, 1999. Alteration No.2 - IPS No.10, 2007	State Committee for Standartization of Ukraine		
2.5.16	Метрологія. Державні випробування засобів вимірювальної техніки. Основні положення, організація, порядок проведення і розгляду результатів	Держстандарт України	ДСТУ 3400:2006	01.04.2007
	Metrology. State tests of measuring techniques means. General provisions., organization, order and consideration of results	State Committee for Standartization of Ukraine		

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2.5.17	Классы точности средств измерений. Общие требования	Госстандарт СССР	ГОСТ 8.401-80	01.07.1981
	Classes of accuracy of measurement means. General requirements	State Committee for Standarti-zation of USSR		
2.5.28	Степени защиты, обеспечиваемые оболочками (код IP)		ГОСТ 14254-96 (МЭК 529-89)	01.01.1997
	Protection levels, provided with environments (code IP)			
2.5.19	Изделия электротехнические. Общие требования в части стойкости к механическим внешним воздействующим факторам. Изменение № 1 - ИПС № 5, 2001	Госкомитет Совета Министров СССР	ГОСТ 17516.1-90Е	01.01.1991
	Electrical products. General requirements as regards stability to external affecting factors. Alteration No.1 - IPS No.5, 2001	USSR Council of Ministers State Committee		
2.5.20	Совместимость технических средств измерения, контроля и управления промышленными процессами электромагнитная. Устойчивость к электромагнитным помехам. Общие положения	Госстандарт СССР	ГОСТ 29073-91	08.07.1991
	Electromagnetic Compatibility of technical means. Devices for measurement, monitoring, and control of production processes. Stability to the electromagnetic interference. General provisions	State Committee for Standartization of USSR		
2.5.21	Совместимость технических средств электромагнитная. Аппаратура измерения, контроля и управления технологическими процессами. Технические требования и методы испытаний на помехоустойчивость	Госстандарт СССР	ГОСТ 29254-91	01.01.1993

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	Electromagnetic compatibility of technical means. Devices for measurement, monitoring, and control of technological process. Technical requirements and methods for testing on interference stability	State Committee for Standartization of USSR		
2.5.22	Совместимость технических средств электромагнитная. Устойчивость к наносекундным импульсным помехам. Технические требования и методы испытаний	Госстандарт СССР	ГОСТ 29156-91	10.12.1991
	Electromagnetic compatibility of technical means. Stability to nanosecond impulse interference. Technical requirements and testing methods	State Committee for Standartization of USSR		
2.5.23	Совместимость технических средств электромагнитная. Устойчивость к электростатическим разрядам. Технические требования и методы испытаний	Госстандарт СССР	ГОСТ 29191-91	01.01.1993
	Electromagnetic compatibility of technical means. Stability to electrostatic charges. Technical requirements and testing methods	State Committee for Standartization of USSR		
2.5.24	Совместимость технических средств электромагнитная. Радиопомехи индустриальные от оборудования информационной техники. Нормы и методы испытаний	Держкомітет України по стандартизації, метрології та сертефікації	ГОСТ 29216-91	1991
	Electromagnetic compatibility of technical means. Industrial radio noise from information technical equipment. Standards and testing methods	State Committee of Ukraine on Standardization, Metrology & Certification		
2.5.25	Грунты. Методы измерения деформаций оснований зданий и сооружений	Госстандарт СССР	ГОСТ 24846-81	01.01.1982
	Soils. Deformation measurement methods for building foundations	State Committee for Standartization of USSR		

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2.5.26	Арматура для оборудования и трубопроводов АЭС. Общие технические требоавния.	Госатомэнергонадзор СССР	ОТТ-87	1987
	Armature for equipment and pipelines of nuclear power plant. General technical requirements	USSR State Atom Inspectorate		
2.5.27	Оборудование для работы с радиоактивными средами. Общие технические требования. Приемка, эксплуатация и ремонт.		ОСТ 95.10439-91	1991
	Equipment for work with radioactive environment. General technical requirements. Acceptance, operation and repair			
2.5.28	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Основные положения	Госстандарт СССР	ГОСТ 25804.1-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. General provisions	State Committee for Standartization of USSR		
2.5.29	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Требования по надежности	Госстандарт СССР	ГОСТ 25804.2-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. Reliability requirements	State Committee for Standartization of USSR		
2.5.30	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Требования по стойкости, прочности и устойчивости к внешним воздействующим факторам	Госстандарт СССР	ГОСТ 25804.3-83	01.01.1984

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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	Equipment, devises, and instrumentation of technological process control system at NPP. Requirements on strength, durability, and stability to external impact factors	State Committee for Standartization of USSR		
2.5.31	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Общие конструктивно-технические требования	Госстандарт СССР	ГОСТ 25804.4-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. General design and technical requirements	State Committee for Standartization of USSR		
2.5.32	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Общие правила проведения испытаний и приемки опытных образцов и серийной продукции	Госстандарт СССР	ГОСТ 25804.5-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. General test and acceptance rules for pilot samples and batch product	State Committee for Standartization of USSR		
2.5.33	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Методы оценки соответствия требованиям по надежности	Госстандарт СССР	ГОСТ 25804.6-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. Methods for assessment of compliance with reliability requirements	State Committee for Standartization of USSR		
2.5.34	Аппаратура, приборы устройства и оборудование систем управления	Госстандарт СССР	ГОСТ 25804.7-83	01.01.1984

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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	технологическими процессами атомных электростанций. Методы оценки соответствия требованиям по стойкости, прочности и устойчивости к внешним воздействующим факторам			
	Equipment, devises, and instrumentation of technological process control system at NPP. Methods for assessment of compliance with requirements on strength, durability, and stability to external impact factors	State Committee for Standartization of USSR		
2.5.35	Аппаратура, приборы устройства и оборудование систем управления технологическими процессами атомных электростанций. Методы оценки соответствия общим конструктивно-техническим требованиям	Госстандарт СССР	ГОСТ 25804.8-83	01.01.1984
	Equipment, devises, and instrumentation of technological process control system at NPP. Methods for assessment of compliance with general design and technical requirements	State Committee for Standartization of USSR		
2.5.36	Надежность атомных станций и их оборудования. Общие положения и номенклатура показателей Изменение № 1 - ИУС № 4, 1987. Изменение № 2 - ИУС № 8, 1990	Госстандарт СССР	ГОСТ 26291-84	01.01.1986
	Reliability of Nuclear Power Plants and their equipment. general provisions and nomenclature of indicators. Alteration No.1 - IUS No.4, 1987. Alteration No.2 - IUS No.8, 1990	State Committee for Standartization of USSR		
2.5.37	Метрологическое обеспечение эксплуатации атомных станций. Основные положения	Госстандарт СССР	ГОСТ 26846-86	01.01.1987
	Metrological support to NPP operation. General provisions	State Committee for Standartization of USSR		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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2.5.38	Системы ядерного приборостроения для атомных станций. Общие требования.	Госстандарт СССР	ГОСТ 29075-91	01.07.1992
	System of nuclear instrument-making for nuclear power plants. General requirements	State Committee for Standartization of USSR		
	2.6. Документы ПОМ / 2.6 SIP Documents			
2.6.1	Стратегия извлечения ТСМ и обращения с РАО (Решение П7 в рамках ПОМ ОУ)	НАЭК «Энергоатом»	SIP-PMU P7	20.12.2000
	FCM removal and RAW management strategy (Decision P7 within the frame of SIP)	NAEK «Energoatom»		
2.6.2	Стратегия безопасного конфайнмента (Решение П10 в рамках ПОМ ОУ)	НАЭК «Энергоатом»	SIP-PMU P10	23.03.2001
	Safe confinement strategy (Decision P10 within the frame of SIP)	NAEK «Energoatom»		
2.6.3	Процедура ГУП-ПОМ. Идентификация технических документов	ГУП ПОМ	ГУП ПОМ 12.5	
	Procedure SIP PMU. Technical document Identification	SIP PMU		
2.6.4	Задача №7. Геотехнические исследования. Отчет о геотехнических исследованиях. Док.7.3	ГУП ПОМ		2000
	Task 7. Geotechnical investigations. Report on geotechnical investigations. Doc.7.3	SIP PMU		
2.6.5	Анализ пожароопасности ОУ. Задача 16 (ред. А)	ГУП ПОМ	SIP-ICC-163-16-63-99013 A	07.07.1999
	Fire hazard analysis of Shelter. Task 16 (rev. A)	SIP PMU		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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2.6.6	Решение ГУП ПОМ по созданию строительной базы	ГУП ПОМ	WBS A 01 2400	24.05.2001
	SIP PMU decision on Stroybaza construction	SIP PMU		
2.6.7	Канализационная насосная станция бытовых сточных вод (N1). Спецификация оборудования	ГУП ПОМ	SIP-03-2-002-01/03 08n/77-07/03-16-1НКС	17.08.2005
	Sewage pump station (N1). Technical specification	SIP PMU		
2.6.8	Плановые и внеплановые отключения коммунальных услуг	ГУП ПОМ	CCN 051558	2005
	Routine and extraordinary switching off for public utilities	SIP PMU		
2.6.9	Технические спецификации. Система основных кранов (ред. А)	ГУП ПОМ	TS-301	06.07.2007
	Technical specifications. Systems of main cranes (rev. A)	SIP PMU		
2.6.10	Исследование транспортной системы демонтажа (ред. В)	ГУП ПОМ	DD-304	28.04.2003
	Deconstruction indoor transportation system (rev.B)	SIP PMU		
2.6.11	Демонтаж основных балок (ред.В)	ГУП ПОМ	DD-303	07.05.2003
	Deconstruction of main beams (rev. B)	SIP PMU		
2.6.12	Демонтаж внутренних конструкций (ред.В)	ГУП ПОМ	DD-305	16.05.2003
	Deconstruction of internal structures (rev. B)	SIP PMU		
2.6.13	Технологическое оборудование обращения с демонтируемыми элементами и сопутствующими РАО (ред. В)	ГУП ПОМ	DD-306	24.04.2003

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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	Dismantled element process equipment and related radioactive waste (RAW) management (rev. B)	SIP PMU		
2.6.14	Ориентировочный расчет годового количества тепла, поступающего в помещения 4 блока и деаэраторной этажерки от техногенных источников	ГУП ПОМ	SIP-P-PM-22-046-SOW-052-009	20.05.2005
	Approximate calculation of the annual amount of heat coming into rooms of Unit 4 and deaerator stack from technogenic sources	SIP PMU		
2.6.15	Процедура для выполнения термодинамического анализа	ГУП ПОМ	SIP K 00 21 000 DEN 002 01	31.10.2003
	Procedure for performance of thermodynamic analysis	SIP PMU		
2.6.16	Требования к испытаниям поликарбонатного пластика	ГУП ПОМ	SIP K 00 21 000 DEN 003 01	31.10.2003
	Test requirements to polycarbonate plastic	SIP PMU		
2.6.17	Концептуальный проект НБК. Отчет по оценке воздействия на окружающую среду (ред. В)	ГУП ПОМ	SIP-P-TM-21-330-EIA-101-01	31.10.2003
	NSC conceptual design. Evaluation of impact onto environment (rev. B)	SIP PMU		
2.6.18	Отчет по анализу грунтов (ред. Б)	ГУП ПОМ	FD-303	09.05.2003
	Report of grounds analysis (rev. B)	SIP PMU		
2.6.19	Техническое обоснование демонтажа вентиляционной трубы (ред. А)	ГУП ПОМ	VS-101	20.06.2003
	Technical justification of ventilation stack removal (rev. A)	SIP PMU		
2.6.20	Сценарии демонтажа вентиляционной трубы (ред. А)	ГУП ПОМ	VS-102	20.06.2003
	Ventilation stack dismantling scenarios (rev.A)	SIP PMU		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
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2.6.21	Предварительный анализ рисков демонтажа вентиляционной трубы (ред. А)	ГУП ПОМ	VS-103	05.05.2003
	Preliminary analysis of risks for ventilation stack dismantling (rev. A)	SIP PMU		
2.6.22	Предварительный анализ альтернативных систем вентиляции второй очереди (ред. А)	ГУП ПОМ	VS-104	10.06.2003
	Preliminary analysis of alternative ventilation systems of the line II (rev. A)	SIP PMU		
2.6.23	Программа научно-технического сопровождения НБК на этапах проектирования. Приложение М	ГУП ПОМ	SIP K 00 21 000 EXN 001 01	23.04.2004
	Program of engineering and technical support for NSC at the design stages. Appendix M	SIP PMU		
2.6.24	Измерения наземных полей Программа излучения. Фаза 2. Отчет по измерениям	ГУП ПОМ	SIP K 01 21 310 MR2 003 02	01.07.2004
	Measurement of over-ground fields of gammaradiation. Phase 2. Measurement report	SIP PMU		
2.6.25	Отчет по определению характеристик РАО западной зоны	ГУП ПОМ		19.04.2002
	Western zone raw characterization report	SIP PMU		
2.6.26	Рабочий проект по стабилизационным мероприятиям. Корректировка отчетов по результатам исследований. Отчет по определению характеристик РАО западной зоны	ГУП ПОМ	SIP K 02 01 000 INR 006 02	09.10.2002
	Detailed design for stabilization: access routes and shielding design, structure and contents. Investigation reports update. Western zone raw characterization.	SIP PMU		
2.6.27	Отчет о НИР «Радиогидроэкологический мониторинг в районе ОУ»	ГУП ПОМ	УДК 556. 314:	29.04.2004

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
	Report on research “Radiohydroecological monitoring in the area of OS”	SIP PMU	504,43.06(477.41)	
2.6.28	Картограмма мощности экспозиционной дозы на ВТ-2	ГУП ПОМ	SIP-P-PM-22-046-SOW-052	2005
	Radiological map of the ventilation stack-2	SIP PMU		
2.6.29	Перечень и генплан взрывопожароопасных объектов ГСП ЧАЭС	ГСП ЧАЭС		2005
	List and general layout of the potentially explosive and fire hazardous objects of SEE ChNPP	SSE ChNPP		
2.6.30	Требования к Подрядчику относительно выполнения программы медицинского и биофизического контроля при работах ПОМ	ГУП ПОМ	CCN 047060	16.11.2004
	Contractor requirements for implementation of SIP medical and biophysical control programm	SIP PMU		
2.6.31	Программа радиационной защиты объекта «Укрытие»	ГСП ЧАЭС	Инв. № 6	05.05.2003
	Shelter radiological protection program	SSE ChNPP		
2.6.32	Програма медичних та біофізичних обстежень для Підрядників ПЗЗ	ГСП ЧАЭС		2004
	Program of medical and biophysical inspections for SIP Contractors	SSE ChNPP		
2.6.33	Анализ АЛАРА демонтажных работ (ред. А)	ГУП ПОМ	SA-304	30.12.2002
	Deconstruction ALARA analysis (rev. A)	SIP PMU		
2.6.34	Проектирование. Строительство. Ввод в эксплуатацию Нового Безопасного Конфайнмента. Объемы работ (ред. 10)	ГУП ПОМ	SIP-P-22-046-SOW-052-010	
	New Safe Confinement Design, Construction, Commissioning (Rev. 10)	SIP PMU		

3. Документы ЧАЭС (информационные) / 3. ChNPP documents (for information)

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
3.1	Технологический регламент объекта «Укрытие реактора блока №4 Чернобыльской АЭС»		1Р-ОУ	07.10.2001
	Technological regulations for Chernobyl NPP Unit 4 object Shelter			
3.2	Контрольные уровни радиационной безопасности	ЦРБ	41П-С	14.11.2006
	The Shelter radiation safety reference levels	RSD		
3.3	План ГСП ЧАЭС реагирования на аварии и чрезвычайные ситуации	ОАГиР	32П-С	17.01.2007
	Plan of SSE ChNPP response to accidents and emergency situations	OAGiR		
3.4	Положение о порядке получения в Госатоминспекции на ЧАЭС разрешений на выполнение работ в рамках международных проектов	ОЛ	14П-С	13.12.2006
	Regulation on obtaining state nuclear inspection at ChNPP authorizations to proceed with work execution in the frame of international projects	LD		
3.5	Положение об организации проведения входного контроля продукции, поступающей для строительства вновь строящихся объектов	СТК	54П-С	15.06.2007
	Regulation on organization of inspection test of goods supplied for construction of new facilities	STK		
3.6	Положение о выдаче разрешений на строительство и реконструкцию объектов строительства на объекте «Укрытие» ГСП ЧАЭС	УКС	59П-С	19.05.2006

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
	Regulations on release for construction and re-construction of jobs at the Shelter of the SSE “Chernobyl NPP”	DCC (Department of Capital Construction)		
3.7	Положение о санитарно-пропускном режиме ГСП ЧАЭС	ЦРБ	77П-С	01.03.2007
	Regulation on SSE ChNPP sanitary and access procedure	RSD		
3.8	Инструкция по пожарной безопасности ГСП «Чернобыльская АЭС»	ОПБ (отдел пожарной безопасности)	22Э-С	14.12.2006
	Instruction on SSE ChNPP fire safety	FSS		
3.9	Система управления качеством. Сертификация закупаемой продукции	ОЛ	СТП 5.006-2003	2003
	Quality control system. Certification of procured products	LD		
3.10	Интегрированная программа обращения с РАО на этапе прекращения эксплуатации Чернобыльской АЭС и преобразования объекта «Укрытие» в экологически безопасную систему	Отдел интегрированного обращения с РАО	2ПР-С	2007
	Integrated programme of RAW management at the ChNPP decommissioning stage and the shelter conversion into an ecologically safe system	Integrated Management of RAW Devision		
3.11	Положение об организации радиационной защиты на ЧАЭС	ЦРБ	28П-С	31.03.2005
	Regulation on organization of radiation protection at SSE ChNPP	RSD		
3.12	Положение о порядке производства радиационно-опасных работ и применения единой нарядно-допускной системы в ГСП ЧАЭС	ЦРБ	24П-С	02.03.2005
	Regulation for implementation of radiation hazardous activities and applications of standard access order (job-card) system at SSE ChNPP	RSD		

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1	3	4	5	6
3.13	Положение по обращению с твердыми радиоактивными отходами на ЧАЭС	ЦПТРО	29П-С	30.05.2006
	Regulation on SRAW management at ChNPP	SWPS		
3.14	Положение о порядке курирования и ведения технического надзора за строительством объектов	УКС	56П-С	22.09.2005
	Regulation on procedure for supervision and technical oversight of facility construction	DCC		
3.15	Положение по обращению с жидкими радиоактивными отходами на Чернобыльской АЭС	ХЦ	68П-С	27.02.2005
	Regulation on LRAW management at ChNPP	ChS		
3.16	Инструкция по организации безопасного проведения огневых работ на объектах ЧАЭС	ОПБ	34Э-С	12.01.2007
	Instruction on organization of safe execution of hot works at ChNPP facilities	FSS		
3.17	Концептуальное техническое решение по обращению с жидкими радиоактивными отходами в процессе преобразования объекта «Укрытие» в экологически безопасную систему	ГСП ЧАЭС		27.10.2006
	The conceptual technical decision on liquid RAW management during Shelter Object transformation into an ecologically safe system	ChNPP		
3.18	Техническое решение на подготовку площадки под строительство НБК, включая работы по очистке и планировке территории, земляные работы под строительство фундаментов НБК (вертикальная планировка) и работы по демонтажу бермы пионерной стены	ГСП ЧАЭС		20.02.2006

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1	3	4	5	6
	Technical decision of site clearance for the NSC construction including activities on site clearance and planning, excavation for the NSC foundation construction (leveling) and activities on deconstruction of pioneer wall berm	ChNPP		
3.19	Анализ состояния конструкций ОУ и анализ полноты исходных данных для моделирования ОУ (ред. 2)	ГУП ПОМ	SIP K TM 21 001 ASC 001 02	2006
	Analysis of the SO structures condition and input data completeness analysis for the SO modeling (rev. 2)	SIP PMU		
3.20	Пояснительная записка к техническому решению «Об утверждении проектных критериев ограничения силовых воздействий на строительные конструкции и основания объекта «Укрытие» в процессе строительства» (ред. 1)	ГУП ПОМ	SIP-P-TM-22-046-EXN-139-01	29.10.2007
	Explanatory note to technical decision «On approval of design criteria to limit power loads on the building structures and bases of the Shelter Object during the NSC first commision stage of construction» (rev. 1)	SIP PMU		
3.21	Предварительный отчет о состоянии строительных конструкций II-очереди ЧАЭС, примыкающих к внешнему контуру НБК, выполняющих ограждающие функции, на основании существующей документации	ГУП ПОМ	SIP-P-TM-21-001-ASC-001-01	16.10.2006
	Preliminary report on condition of building structures of ChNPP 2nd turn adjoining NSC external pipeline and performing enclosing functions based on available documents	SIP PMU		
3.22	Анализ рисков, связанных с пожаром на новом безопасном конфайнменте (ред. 2)	ГУП ПОМ	STS-SS-21-330-RPT-002-02	17.08.2005
	Analysis of risks applied to fire in the new safe confinement	SIP PMU		

№ п/п /No.	Название документа / Document Title	Организация, утвердившая / выпустившая документ / Organization which approved/ issued the document	Номер документа/ Document Reference	Дата/Date
1	3	4	5	6
3.23	Отчет по защите от потенциального облучения (ред. В)	ГУП ПОМ	SIP-P-TM-21-330-PE-101-01	28.09.2004
	Protection from potential exposure (rev. B)	SIP PMU		
3.24	Концептуальный проект НБК. Сбор характеристик площадки НБК и других данных (ред. А)	ГУП ПОМ	SA-301	24.10.2002
	NSC conceptual design. NSC Site Characteristics and Other Data Collection Characteristics of NSC site and acquisition of another data (rev. A)	SIP PMU		
3.25	Определение и анализ рисков (ред. А)	ГУП ПОМ	SA-302	27.09.2002
	Hazards Identification and Analysis (rev. A)	SIP PMU		
3.26	Анализ предельных условий эксплуатации НБК (ред. А)	ГУП ПОМ	SA-303	14.02.2003
	Analysis for Limiting Conditions for NSC Operation (rev. A)	SIP PMU		
3.27	Отчет о состоянии безопасности объекта «Укрытие» (ред. 4)	ДКЯРУ	SIP-P-PM-22-460-SAR-124-04	28.02.2008
	Shelter object safety status report (rev.4)	SNRC of Ukraine		
3.28	Требования к точкам подключения	ГУП ПОМ	SIP-P-PM-22-046-SOW-052-009	2005
	Requirements for tie-ins connection points	SIP PMU		
3.29	Генеральный план точек подключения	ГУП ПОМ	SIP-P-PM-22-046-SOW-052-009	2005
	Site layout for tie-ins connection points	SIP PMU		
3.30	Design accelerograms for the ChNPP site	SIP PMU A24	SIP03-1-004	27.04.2005
	Расчетные акселерограммы для площадки ЧАЭС	ГУП ПОМ П24		

A.2.2 - LIST OF TERMS AND DEFINITIONS

ALARA PRINCIPLE – Keeping exposures as low as reasonably achievable, with social and economic factors being taken into account.

COMMUNAL ACCIDENT – Radiation accident the consequences of which are not limited by the facility and its industrial site, but spread to the adjacent territories resided by the public who can actually or potentially suffer the exposure.

CONCEPTUAL DESIGN – A definition of the document in accordance with the western practice, corresponding to the “Feasibility Study” term in this document.

BORDERS OF NSC – structures of NSC that must ensure reliable isolation from environment of radioactive substances located at the Shelter including during extreme external events of natural and man-caused origin and also during internal events. In accordance with FS-NSC this construction include such ones: arch vault; western and east front walls assembled of new constructions of frame structure, new external structures of technological building and existing structures of the Shelter that are located over the perimeter of arch vault.

CLIENT - State Specialized Enterprise “Chernobyl NPP” of the Ministry of Fuel and Energy of Ukraine.

CRITICAL EVENT – an event leading directly of occurrence of the potentional exposure. A critical event can be a combination of multiple specific critical events.

DISPOSAL OF RADIOACTIVE WASTE - The placement of radioactive waste in the object assigned for radioactive waste management without any intention of their subsequent use.

DESIGN – a design stage in accordance with ДБН А.2.2-3-2004 [1.7.31]. Considered a Detailed Design stage (Western terminology).

DETAILED DESIGN – Western terminology for a design stage. Corresponds to twostage design process in accordance with ДБН А.2.2-3-2004 [1.7.31] – Design (D) + Working Documents (WD).

ELEMENTS - Equipment, devices, pipelines, cables, structures and other products, which ensure performance of established functions either separately or as part of a system, and, which are considered as project structural units during performance of the reliability and safety analysis.

ENVIRONMENTALLY SAFE SYSTEM – Ecological sub-system (that is part of natural circulation), which state is controlled and excludes hazard of worsening of environmental conditions and occurrence of hazard for health people

EXPOSURE – Effect of ionizing radiation from sources located outside the body (external exposure) or from sources located inside the body (internal exposure).

Potential – exposure of personnel and public, which is considered during design of practical activity, and occurring immediately after some unforeseen normal technological process of critical event which occurrence probability does not exceed $1 \cdot 10^{-2}$ year^{-1}.

Current – planned exposure of personnel and public, which normally occurs (or can occur with very high degree probability)

EXPOSURE OF PUBLIC – Radiation, which human being is exposed to (was exposed), from nuclear facilities and sources of ionizing radiation, excluding occupational and medical exposure and exposure, caused by local natural radiation background.

FAILURE – Disruption of an object’s functionality, i.e., loss of its capability to perform the required function.

FUEL CONTAINING MATERIALS (FCM) - ChNPP Unit-4 nuclear fuel , damaged as a result of the beyond-the-design-basis accident, regardless of its physical and chemical state, Unit-4 cooling pond fuel assemblies , as well as any materials (core fragments, mixtures, melts, solutions, chemical compounds, dust, etc.), which consist of nuclear fuel and its content makes more than one percent by weight

FCM (RAW) REMOVAL – Transportation of RAW (FCM) from the places of their nonorganized location inside the Shelter and at the Shelter Industrial Site to the FCM (RAW) Storage Facility, i.e. Shelter FCM (RAW) transfer to the controlled state.

GAS-AEROSOL REALESE (RELEASE) – egress of radioactive substances into the environment from technological circuits and ventilation system of enterprise

GAS-AEROSOL REALESE NSC – as a total egress of radioactive materials outside NSC protective structure into atmosphere, including: trough ventilation system of NSC and the Shelter, through non-tightness in external fencing structures of NSC protective structure.

GROUPS OF POTENTIAL RADIATION SOURCES:

Groups 1 – Sources of potential exposure, which can lead to the exposure of some individual or a limited group of people.

Groups 2 – Sources of potential exposure that are related to radiation accident, which aftermath can include exposure of significant contingents of public and/or radioactive contamination of the environment

INSPECTION – Set of activities on collection, processing, classification and analysis of data on a technical state of structures including existing defects and damages, as well as assessment of the structures' deterioration.

LIQUID DISCHARGE (DISCHARGE) – egress of radioactive substances generated or used on-site into the environment (off-site) with sewage

LIQUID DISCHARGE NSC – as a total egress of radioactive materials into the environment (outside NSC industrial site) with wasters of NSC and the Shelter.

LONG-LIVED WASTE - Radioactive waste, the level of exemption of which from the control of the authority for the state regulation of nuclear and radiation safety is reached within 300 years or later after their disposal.

NORMAL OPERATION - work of enterprises in operating modes stipulated by the regulation established. Activity on normal operation of complex of structures, systems and equipment of NSC and the Shelter should be determinated in the corresponding technological regulation and include with the help of this complex of structures, systems and equipment implementation of technological objective directed on transformation of the destroyed unit into ecologically safe system and on protection assurance of the personnel, population and environment from radiological dangers. Operation also includes technical service and repair of structures, systems and equipment of NSC and the Shelter.

NSC FIRST COMMISSIONING STAGE (NSC CS-1) - protective facility with technological life-support systems and NSC Status Monitoring Systems as well as needed infrastructure for NSC operation.

NSC SECOND COMMISSIONING STAGE (NSC CS-2) - infrastructure for deconstruction of the SO unstable structures.

NUCLEAR MATERIAL - Any source or special fissionable material.

NUCLEAR SAFETY - Compliance with norms, regulations, standards and conditions of the use of nuclear materials for radiological equipment and radiological safety.

OBJECT – A separate building or a facility with engineering equipment, utility lines and communications, as well as their complexes with definite construction and production purposes, for which an individual design is developed and permission for construction work is given.

OBJECT SAFETY – Ability of an object to confine the influence of hazard sources on personnel, population and the surrounding environment in accordance with established limits under normal operational conditions and in case of an accident.

OBJECT SHELTER (OS) is an object presented by a set of facilities and systems (elements) that form a system of technical means designed for protection of personnel, public and environment against radiological hazards due to the RAW remaining in this facility. The OS consists of:

- block B of ChNPP SC-II (Unit 4) destroyed during the accident, having block B separation walls in axes 39-41, and block D in rows В-Г, axes 39-52;
- structures installed around Unit 4, including slabs over the reactor hall, deaerator stack and turbine hall;
- part of block B of ChNPP SC-II up to separation wall in rows Г-Т and in axes 39-41;
- part of the island auxiliary systems in У-Ю rows and 41-44 axes;
- part of the G block in rows А-Бfrom the separation wall in axis 34 up to axis 68;
- part of the D block in Б-В rows and axes 37-68;
- the territory within the restricted area with control and monitoring devices installed (Local Zone);
- nuclear and radioactive materials accumulated within the above-mentioned territory;
- facilities, systems and elements designed for authorized operations at the Object Shelter and their safe performance.

OPERATION OF A BUILDING OR STRUCTURE – Use of a building or structure according to its purpose with implementation of the measures required to maintain such a state of the structures, in which they can perform assigned functions with the parameters specified by technical documents.

OPEN IONIZING RADIATION SOURCE – Radionuclide source the work with which could lead to the release of radionuclides to the environment.

PRIMARY RAW MANAGEMENT – Decontamination, collection, sorting of RAW.

PROTECTION SAFETY BARRIER – An aggregate of structural elements enclosing the space around sources of ionizing radiation, and forming design border. These elements impede the spread of radioactive substances to the industrial rooms and environment in excess of established limits.

QUALITY ASSURANCE – A set of measures, planned and systematically implemented with the purpose to be sure that the performed types of activities comply with norms, regulations, and standards of safety.

RADIOLOGICAL PROTECTION - The complete program of radiological and hygienic, research and development, technical and organizational measures aimed to ensure radiological safety.

RADIOLOGICAL SAFETY - Compliance with permissible limits of radiological impact on the personnel, public and environment, regulated by the safety norms, rules and standards

RADIOLOGICAL SAFETY DURING RAW MANAGEMENT – keeping the radiation impacts on workers, public, and environment within acceptable limits, established in norms, regulations, safety standards, as well as restricting migration of radionucliedes into environment.

RADIOACTIVE WASTE - Material objects and substances, the radionuclide activity or radioactive contamination of which exceeds limits, established by the existing standards, on condition that utilization of these objects and substances is not envisioned.

RAW MANAGEMENT – An activity related to the collection, treatment, transportation, storage and disposal of radioactive waste

SAFE CONFINEMENT (NEW SAFE CONFINEMENT) NSC – protective facility including a complex of technological equipment for removal from the ruined Unit 4 of Chernobyl NPP of the materials containing nuclear fuel, radioactive waste management, and other systems is designed for implementation of activities on conversion of this unit into environmentally safe system as well as ensuring personnel, public and environmental safety.

SAFETY FUNCTION - The specific objective with indication of certain actions that shall be taken to achieve the above objective, prevent the accident or mitigate its consequences.

SANITARY PROTECTED ZONE - Any territory around an ionizing radiation source outside the place or zone of Category A personnel work, where level of the human being exposure under ionizing radiation source normal operation can exceed a quota of the dose limit for Category B.

SHORT-LIVED WASTE – Radioactive waste, the level of exemption of which from the control of the authority for the state regulation of nuclear and radiation safety is reached within less than 300 years after their disposal.

SOURCE OF IONIZING RADIATION - An object that contains radioactive material or a technical device that creates or under specific conditions may create ionizing radiation. During designing any practical activities, a source of ionizing radiation is considered as a source of both current and potential exposure.

STRUCTURE (FACILITY) - A three-dimensional, flat or linear at grade, aboveground or underground construction system consisting of load-bearing, in some cases, enveloping structures, which is intended for the performance of different types of production processes, storage of materials, products and equipment, as well as for the temporary occupancy of people, and relocation of people and supplies.

SYSTEM - Combination of elements intended for the performance of established functions.

SYSTEMS (ELEMENTS) OF NORMAL OPERATION - Systems (elements) designed to perform a normal operation.

WORKING PLACE – place (room) for permanent of temporary staying of personnel during working activity process connected with sources of ionizing radiation. If ionizing radiation source are operated at different section of room, then the whole room is considered as working place.

WORKING PLACE NSC – as places of permanent on temporary presence of the operation personnel during implementation of works and operations on operation of complex of structures, systems and equipments of NSC and the Shelter. If these works and operations are carried out in different places of structure, premise, site, etc working places are considered all facilities, rooms, areas, etc. There should be established WP borders and routes of access to them. The document titled “Design Criteria for NSC Potential Exposure Restriction” uses the term working place in a broad sense and it covers presence of workers at industrial sites of NSC and ChNPP during their arrival, departure and lunch break, etc.

A.2.3 - BASIC REGULATORY REQUIREMENTS FOR ZONING OF NSC CS-1 ROOMS

Document [1.2.3] identifies requirements for zoning of rooms to be met in the NSC design. Below are extracts of the main requirements from [1.2.3] (including the numeration of [1.2.3] Sections [1.2.3]).

12.1.9. Class I activities shall be carried out in a separate building or reliably isolated part of the building with an entry through air lock. Operating rooms shall be equipped with leak-tight boxes, chambers, canyons and other similar leak-tight equipment. Industrial rooms for class I activities are divided, as a rule, into three zones.

12.1.10. Zone 1 – unattended rooms and rooms housing process equipment and service lines that may be the main sources of radiation and radioactive contamination. Personnel are not permitted to stay in rooms of this zone in operation of process equipment. ….rooms of zone 1 are separated from rooms of zones 2 and 3 with special doors (or other additional physical protection systems for reliable prevention of unauthorized access to zone 1). In exceptional cases, personnel are permitted to enter into unattended rooms of zone 1 in operation of process equipment on the basis of special permits for equipment inspection (repair) in strict compliance with programs and procedures approved by the enterprise administration and taking into account additional administrative and technical radiation protective measures.

12.1.11. Zone 2 – periodically-attended rooms intended for repair of contaminated equipment, other activities associated with opening of process equipment, as well as temporary storage of raw materials, radioactive waste and finished products.

12.1.12. Zone 3 – rooms that are permanently attended over the entire shift (operator's panel, control panels). Administrative and office rooms, medical post, shops for repair of uncontaminated equipment and tools, storages for non-radioactive materials, central control panel, rooms for electrotechnical equipment, input ventilation systems and exhaust ventilation units.

In order to prevent potential release of radioactive contamination from zone 2 into zone 3, an air lock shall be arranged between them.

12.1.17. In the operation of rooms dealing with class I activities, high effectiveness of radioactivity confinement shall be ensured with use of static (equipment, walls, coverings) and dynamic (ventilation, gas treatment) barriers. Process equipment used for activity confinement shall ensure the designed level of tightness.

12.1.18. The effectiveness of protective barriers shall be maintained at the designed level and continuously monitored in operations with unsealed sources.

12.1.20. Pressurized equipment (vessels, piping) and related equipment for the collection and treatment of discharge water and gases shall be regarded as the first confinement barriers in operations with liquid radioactive materials. Glove box, chamber or storage container is the first confinement barriers for operations with solid radioactive materials. The second barrier is formed with the walls of boxes or chamber and associated ventilation systems. The third confinement barrier is presented by structures of zones 2 and 3 and associated building and ventilation systems.

12.1.23. For activities of classes I and II – the controls of common heating, gas supply, compressed air supply and water supply systems and group electrical panels shall be located outside the rooms where these activities take place.

12.1.26. To manufacture process and protective equipment, slightly-sorbing materials or coatings resistant to applied substances, reagents, decontamination acid and alkaline solutions shall be used.

12.1.27. Special slightly-sorbing materials, which are resistant to cleaning agents, shall be coated on the floor and walls in rooms for class II activities and for class I activities in zone 3, and additionally on the ceiling in zones 1 and 2 for class II activities. Rooms for activities of different classes and different zones shall be painted in different colors.

12.1.28. The edges of floor coverings shall be turned up at a height of about 10 cm and fixed on walls. If there are drains, floors shall have inclinations. The corners of rooms shall be rounded. Door planes and window crosses shall have simple profiles.

12.1.29. The height of rooms for work with radioactive materials shall meet regulatory requirements for chemical laboratories. The area of rooms for class I and class II activities per worker shall be taken not less than 10 m^2.

12.1.30. Equipment and working furniture shall have smooth surface, simple design and slightly-sorbing covering for easier removal of radioactive contamination.

12.1.35. For operations with unsealed sources, each enterprise shall allocate a room or place for storage of means for removal of unanticipated contamination (decontamination solutions, inventory for cleaning of rooms).

12.1.36. External and internal exposure of personnel in operations with unsealed sources shall be decreased through additional measures:

- Remote and automated maintenance of the facility;
- Protection (shielding) of equipment where a large amount of Radioactive material is concentrated;
- Minimization of dose rate in the room through shielding.

Document [2.1.1] sets in detail some provisions of [1.2.3]. Below are extracts of basic requirements from [2.1.1] (with the numeration of Sections [2.1.1]):

“6.1 … The designs shall clearly identify to which category a specific room of the strict-access area belongs.

6.5 Isolation between zones and rooms inside the strict-access area shall be provided by engineering features, shielding, ventilation and sanitary appliances, stationary and temporary air locks.

6.6 The entrance into rooms of the strict-access area shall be arranged through changing facilities for personnel.

6.7 The entrance of personnel into unattended rooms when process equipment is in operation shall be arranged through air locks. For installation of portable air locks, appropriate places or sites equipped with special drainage, hot and cold water, preparation of decontamination solutions shall be envisioned.

6.11 Lines for the supply of water and washing solutions, as well as equipment for mechanized cleaning and decontamination, shall be provided in the rooms of the strict-access area. The floors in these rooms shall have inclinations and drains for water flow into special drainage system.

6.14 All fire (emergency) entrances to and exits from the strict-access area are provided with leak-tight doors.

6.17 All surfaces in the strict-access area and their joints shall be as smooth as possible, without dents, cracks and irregularities. Points of contact between walls and floor shall be rounded. Windows without sills shall be provided.

6.19 Rooms containing lines with radioactive liquids shall have reliable waterproofing to avoid the penetration of radioactive media into lower rooms and soil".

A.2.4 - BASIC REGULATORY REQUIREMENTS FOR DESIGN OF NSC CS-1 SANITARY FACILITIES

Below are extracts of the main requirements from [1.2.3] (including the numeration of [1.2.3] sections).

"12.6.1. Sanitary facilities and their equipment shall comply with construction standards, codes and requirements [1.2.3]. A set of sanitary facilities shall include sanitary locks for men and women, air locks.

12.6.11. Stationary air locks shall be located on the boundary of zone 1 and 2 working rooms, and on the boundary of zone 3 if necessary. The arrangement of an air lock depends on the presence or potential for surface radioactive contamination and need for change of additional IPM for work in the above zones. Depending on the scope and nature of the work, an air lock shall include the following:

- Places for changing and storage of additional IPM on racks or in cases (pressure suits, overalls, aprons, oversleeves, gloves, boots, shoe covers, respirators); means for preliminary treatment of workers' footwear (special trays); place with a disciplining barrier for change of additional footwear provided with racks;
- A point for preliminary washing (decontamination) of pressure suits immediately on personnel before taking them off;
- A point for collection of contaminated overalls and IPM, which is equipped with benches and containers for the collection and transportation of these clothes to special laundries; a point for decontamination of additional IPM made of polyvinylchloride film, rubber and rubberized fabric;
- A radiation monitoring point equipped with radiological instrumentation;
- Washbasins with hot and cold water and canisters with decontamination solutions for washing of hands; a point for change of main overalls if contaminated in excess of reference levels.

12.6.12. The area of rooms of a stationary air lock shall be estimated in accordance with layout features taking into account key personnel and those involved in repair and emergency measures. The location, composition and area of air lock rooms may be changed depending on the nature and scope of work.

[…]

12.6.14. Portable air locks are installed to reduce or prevent radioactive transfer from zone 1 rooms or from repair-work rooms to other rooms.

The portable air locks provide for:

- Changing and storage of pressure suits;
- Decontamination of pressure suits immediately on workers.

[…]

6.19. The washbasins shall be provided with water faucets which can be opened by an elbow or foot or provided with sensors. The toilets shall be flushed with pressing a pedal or automatically.

[…]

12.6.21. The wardrobe for overalls shall provide for place for changing – 0.8 m^2 per person.

12.6.22. Personal clothes and overalls shall be stored only in closed lockers. The surface of lockers for overalls shall be coated with materials that slightly absorb chemical and radioactive substances and are easily cleaned and decontaminated.

12.6.23. Overalls shall be sorted and packaged by personnel immediately after taking them off depending on the type and extent of contamination. For this purpose, radiological monitoring devices shall be provided in the storage rooms for overalls.

12.6.24. Separate storerooms for contaminated and clean clothes (daily stock) for all personnel shall be equipped near the wardrobes of the changing facilities. Contaminated overalls shall be delivered to the storeroom in packages.

12.6.25. The layout of storerooms for contaminated overalls shall provide for their convenient transport to laundry: with an exit outside not entering into other clean rooms. The storeroom for contaminated overalls shall be located near the radiological monitoring point and wardrobe for overalls.

12.6.26. The rooms for storage and distribution of IMP (respirators, spectacles, aprons, additional footwear) shall be located in a zone free of contamination, on the way from the overalls wardrobe to working rooms. The area of the room shall be determined by the number of personnel on the list; the standard is 0.2 m^2 per person.

12.6.27. Shower rooms shall be located near the overalls wardrobe. The shower cubicles shall be equipped with holders for washing items and foot grating. The number of jets in the shower room is determined in compliance with Construction Standards and Codes.

12.6.28. Washbasins with hot and cold water for preliminary hand treatment shall be arranged before shower rooms on the side of the overalls wardrobe. The washbasins shall be provided with a pedal or faucets which can be opened by an elbow or with sensors, as well as with mouth wash fountains. The number of washbasins is estimated as follows: 1 washbasin per 10-12 persons in the largest shift.

12.6.29. Rooms for body wiping shall be provided near the shower rooms of the changing facilities. The area of these rooms shall be estimated as follows: 0.4 m^2 per shower jet, but not less than 4 m^2. These rooms shall be provided with fittings for storage of the necessary number of clean towels and container or plastic bags for used ones.

12.6.30. To prevent epidermophytosis, individual rubber sandals shall be issued to personnel in the changing facility, and a place for sanitary treatment of feet shall be provided at the exit from the shower room.

12.6.32. Monitoring means are selected depending on the types of radiation to be monitored and the nature of monitoring. Instrumentation for express monitoring of surface contamination shall ensure the detection of levels not less than 0.5 of relevant reference levels with the 98% probability.

12.6.33. Devices for express analysis of radionuclide content in the human body shall ensure the detection of levels not less than 0.3 of the dose limit with the 98% probability.

12.6.34. The number of devices placed in the changing facilities and air locks shall be calculated on the basis of the time needed to monitor workers in the largest shift, but not more than 20 minutes.

12.6.35. The 1430 changing facility building for enterprises dealing with class I activities is providing:

Express analysis of gamma-emitting radionuclides in human body;

Skin monitoring.

[…]

Document [2.1.1] sets in detail some provisions of [1.2.3]. Below are extracts of the basic requirements from [2.1.1] (with the numeration of [2.1.1] Sections):

11.19 If portable (temporary) air locks cannot be installed, disciplining barriers are provided at the exits from contaminated rooms for change or decontamination of shoes (footwear).

The stationary air lock shall include the following:

- Places for putting on, taking off, and storing additional IPM used by personnel in repairs;
- IMP may be stored on racks or in cases;
- A device for cleaning of footwear soles immediately on workers;
- A point for footwear change, provided with racks;
- A point for preliminary decontamination of pressure suits immediately on individuals before their taking off;
- A section for collection of contaminated IPM;
- A section for decontamination of additional IPM made of PVC film, rubber and rubberized fabric;
- A radiological monitoring point, including radiometry devices, as well as washbasins with hot and cold water and canisters with decontamination solutions;
- A point for change of the main overalls in case of substantial radioactive contamination;
- A section for collection of solid radioactive waste.

11.22 Lavatories shall be provided near permanently-attended rooms. The distance from workplaces to the lavatories shall not be more than 75 m. The toilets shall be flushed with use of a pedal or with periodic flush. The washbasins shall have hot and cold water; paper towels or electric driers shall be provided”.

A2.5 - BASIC REGULATORY REQUIREMENTS FOR DESIGN OF HEATING, VENTILATION AND AIR CONDITIONING SYSTEM (HVAC) OF NSC CS-1

Below are extracts of the basic requirements from [1.2.3] (with the numeration of [1.2.3] Sections).

12.2.1. In operations involving unsealed radiation sources, ventilation and air treatment facilities shall provide protection of air in working rooms and atmospheric air against radioactive contamination at appropriate levels. Airflows shall go from rooms with less potential for contamination to rooms with greater potential for contamination; positive pressure valves shall be installed to prevent the reverse airflow.

12.2.2. The heating, ventilation and air conditioning systems of industrial buildings and structures, as well as systems of ventilation releases to the atmosphere and air pre-release treatment shall be designed in compliance with codes and sanitary standards for design of industrial enterprises.

Permissible values of radioactive releases to the atmosphere are established when necessary, and on an obligatory basis for enterprises dealing with class I activities. Enterprise radiation health and safety regulation “Permissible Releases of Radioactive Materials” is developed in compliance with NRBU-97 and is subject to agreement with state health and epidemiological service of the Ministry of Health of Ukraine.

The Ministry of Health and SNRCU established the “Design Permissible Levels for New Safe Confinement” [1.2.6].

12.2.3. The use of an air recirculation system without treatment from radioactive and toxic substances and without aeration is prohibited in rooms dealing with class I and II activities.

12.2.4. In buildings where only some part of the total area is allocated for work with radioactive materials, separate ventilation systems shall be provided for rooms dealing with radioactive materials and for rooms not associated with the use of radioactive materials.

12.2.5. The entrances to the rooms where equipment for input ventilation is mounted shall be located outside the building or in a permanently-attended area.

12.2.14. A permanent exhaust ventilation system in storerooms, working rooms and boxes shall be provided for work involving emanating and volatile radioactive materials. The system shall be equipped with a redundant exhaust with the efficiency not less than 1/3 of the total design capacity.

12.2.15. In rooms for class I and II activities in case of equipment location by zones, devices are needed for connecting the hoses of isolating individual protection means and portable exhaust facilities to the active vacuum exhaust ventilation system in order to permit welding operations in the equipment zone and in repair and transportation zone. The use of ventilation systems for this purpose is not permitted.

12.2.17. The main requirements for selecting and installing gas treatment systems and facilities for class I and II activities are as follows:

- The number of gas treatment equipment items is minimal;
- The processes of maintenance, repair and replacement of gas treatment equipment are mechanized and automated, and are controlled remotely if necessary;
- Automated alarm and effectiveness monitoring systems are provided for cleaning devices and filters and for the entire gas treatment system and its individual parts and stages in case of a multi-stage system;

- Gas treatment equipment is reliably isolated as a radiation source in order to ensure the personnel safety in equipment inspection and maintenance.

12.2.19 If gas treatment equipment is located in individual rooms, building parts or separate buildings, the same requirements as those for the main industrial rooms shall be imposed on them. When gas treatment equipment is located in the attics, they shall be equipped as a technical floor.

12.2.20. The rooms housing gas treatment equipment shall be isolated and have no air communication with the main industrial rooms and zones. The entrance to and exit from such rooms shall be arranged through a separate air lock.

12.2.21 Isolated rooms or hermetic ventilated sections for repair, temporary storage of filters, devices, their components and for temporary storage of cleaning and decontamination agents shall be obligatory provided in buildings housing gas treatment equipment. A closed system for periodic regeneration shall be arranged for filtering self-treatment devices. Spent filters shall be transported in shielded containers in accordance with rules for radioactive cargo transportation.

12.2.23. An air supply system shall be provided for class I activities in zones 1 and 2. The supplied air shall have the radionuclide concentration not more than permissible values for air supply to hose-type individual protection means (pressure suites, pressure helmets, hose gas masks). The system shall have air distributors for simultaneous connection of not less than 2 hose-type individual protection means.

12.2.24 For air supply to hose-type individual protection means, it is necessary to install a separate pneumatic line or individual input chamber equipped with fine aerosol filters or ventilators providing 500 mmH_2O in the hose/suit connection point, given airflow rate not less than 15 m^3 per suit.

12.2.25. The power networks for energy supply to hose-type individual protection means shall be made of corrosion-resistant materials. Hose connection places shall be provided with ball- or spring-type automatic valves.

12.2.26. Rooms where radioactive materials are used shall be water- or air-heated as required by construction codes and standards. Air heating combined with input ventilation systems shall be provided in rooms for class I and II activities.

Below are extracts of the basic requirements from SP AS-88 (with the numeration of SP AS-88 Sections):

10.2 Ventilation systems of the strict-access area rooms of different categories (unattended, periodically-attended, permanently-attended) are prohibited to be linked by air ducts.

10.4. …. input-exhaust, exchange and process mechanically-driven ventilation systems shall be provided.

The number of ventilation systems shall be determined by the radiation and fire category of rooms and layout of rooms.

10.6 …. it is necessary to prevent the ingress of air released from ventilation pipes and process exhaust lines into air intake devices of the input ventilation systems.

10.7 The installation of coarse aerosol filters on the exhaust systems for strict-access area rooms is recommended to decrease the lifetime of fine aerosol filters of exhaust systems.

The filters of all input systems shall ensure not less than 80% effectiveness of air treatment from airborne radioactive particles.

10.8 ….air conditioning systems with positive air pressure shall be envisioned for permanently-attended rooms (control panels, operator's panels etc.) where stable conditions shall be maintained. The control boards shall be ventilated by self-supporting air conditioning systems.

The closed-mode operation of the air-conditioning system shall be provided in the event of emergency contamination of atmospheric air.

10.9 The ventilation units and filters of exhaust systems in the strict-access area shall be centralized in isolated rooms, which shall not be used as evacuation routes or personnel routes to equipment not related to ventilation systems.

10.10 The ventilators of the exhaust systems removing air contaminated with radioactive gases and aerosols shall be located, as a rule, in isolated rooms.

The drives and engines of the ventilation units shall be located, as a rule, in attended rooms…

10.11 The recirculation operation of ventilation systems intended for keeping health and safety air parameters is prohibited in permanently-attended and periodically-attended rooms of the strict-access area.

Recirculation ventilation units may be used for heating and air blanketing in exits for transport vehicles.

10.12. Self-contained air cooling systems, which are not connected with common air exchange systems maintaining health and safety air parameters, may be used for air cooling of rooms.

10.13 Recirculation ventilation systems may be used to maintain appropriate operating conditions of process equipment within containments and unattended rooms to be pressurized.

If necessary, recirculation systems shall provide for treatment of some part of the total air volume. The effectiveness of air treatment shall ensure controlled radiological conditions in ventilated rooms.

10.14 If enclosures of containments and unattended rooms to be pressurized have metal lining, the ventilation systems in these rooms shall maintain negative pressure no less than 200 Pa (20 kgf/m^2) relative to permanently-attended rooms.

If there is no metal lining in unattended rooms to be pressurized, negative pressure no less than 100 Pa (10 kgf/m^2) may be permitted.

In unattended rooms not to be pressurized and periodically-attended rooms, the ventilation systems shall maintain negative pressure no less than 50 Pa (5 kgf/m^2).

10.20 If air is supplied directly to periodically-attended rooms, they shall be ventilated with 20% excess of the removed air as compared with supplied air.

10.21 Self-supporting input systems with aerosol or iodine filters in the event of emergency contamination of outdoor air shall be provided for control rooms.

10.22 Exhaust and input systems covering rooms of the strict-access area shall have redundant ventilation units, devices for their automatic actuation.

Redundant treatment equipment shall be provided on exhaust ventilation systems ensuring pre-release air treatment.

10.24 Fast-acting isolation valves shall be installed within rooms and outside the containment on air ducts of ventilation systems for normal operating conditions in containments or unattended rooms to be pressurized.

Two safety isolation valves may be installed only outside the containment on air ducts of periodically-operating systems. The air ducts of ventilation systems shall withstand the pressure to be provided in the rooms.

10.25 The fast-acting isolation valves installed on air ducts of ventilation systems shall be closed upon pressure increase within containments and unattended rooms to be pressurized if the performance of these ventilation systems is not required to confine the accident.

10.26 Air ducts of exhaust and input systems shall be made of material with respect to explosion and fire safety requirements. Air ducts of ventilation systems, control and isolation valves, compression devices of filters shall be provided with corrosion-resistant coating selected with regard to corrosiveness and temperature of transferred air.

10.31 The filtering stations shall be provided with devices to determine the effectiveness of air treatment by exhaust systems.

10.32 Spent filters shall be replaced and transported with use of shielded containers.

10.46 The ventilation systems intended for unattended rooms to be pressurized and fast-acting isolation valves installed on the systems shall be controlled and monitored remotely from the main control room (MCR).

The ventilation systems intended for unattended rooms not to be pressurized, periodically-attended and permanently-attended rooms shall be controlled and monitored from the central ventilation control board. In addition, in situ control of these systems shall be envisioned.

10.47 MCR remote control of air temperature and negative pressure shall be envisioned for unattended room to be pressurized.

Monitoring of air temperature shall be ensured in rooms of the strict-access area with potential for heat release, and so shall be monitoring of negative pressure if radioactive contamination is expected.

Instrumentation shall be located on the observation board or installed directly at rooms.

10.50 The ventilation systems covering radiation-hazardous rooms and the duct shall be provided with air flow rate control devices.

A2.6 - BASIC REGULATORY REQUIREMENTS ON RADIATION SAFETY FOR HVAC SYSTEMS

2.1 [1.2.3] identifies requirements on "Ventilation, gas treatment, heating" to be met in the NSC design. Below are extracts of the basic requirements from [1.2.3] (with the numeration of [1.2.3] Sections).

12.2.1. In operations involving unsealed radiation sources, ventilation and air treatment facilities shall provide protection of air in working rooms and atmospheric air against radioactive contamination at appropriate levels. Airflows shall go from rooms with less potential for contamination to rooms with greater potential for contamination; positive pressure valves shall be installed to prevent the reverse airflow.

12.2.2. The heating, ventilation and air conditioning systems of industrial buildings and structures, as well as systems of ventilation releases to the atmosphere and air pre-release treatment shall be designed in compliance with codes and sanitary standards for design of industrial enterprises.

Permissible values of radioactive releases to the atmosphere are established when necessary, and on an obligatory basis for enterprises dealing with class I activities. Enterprise radiation health and safety regulation "Permissible Releases of Radioactive Materials" is developed in compliance with NRBU-97 and is subject to agreement with state health and epidemiological service of the Ministry of Health of Ukraine.

The Ministry of Health and SNRCU established the "Design Permissible Levels for New Safe Confinement".

12.2.3. The use of an air recirculation system without treatment from radioactive and toxic substances and without aeration is prohibited in rooms dealing with class I and II activities.

12.2.4. In buildings where only some part of the total area is allocated for work with radioactive materials, separate ventilation systems shall be provided for rooms dealing with radioactive materials and for rooms not associated with the use of radioactive materials.

12.2.15. In rooms for class I and II activities in case of equipment location by zones, devices are needed for connecting the hoses of isolating individual protection means and portable exhaust facilities to the active vacuum exhaust ventilation system in order to permit welding operations in the equipment zone and in repair and transportation zone. The use of ventilation systems for this purpose is not permitted.

12.2.17. The main requirements for selecting and installing gas treatment systems and facilities for class I and II activities are as follows:

- The number of gas treatment equipment items is minimal;
- The processes of maintenance, repair and replacement of gas treatment equipment are mechanized and automated, and are controlled remotely if necessary;
- Automated alarm and effectiveness monitoring systems are provided for cleaning devices and filters and for the entire gas treatment system and its individual parts and stages in case of a multi-stage system;
- Gas treatment equipment is reliably isolated as a radiation source in order to ensure the personnel safety in equipment inspection and maintenance.

12.2.19 If gas treatment equipment is located in individual rooms, building parts or separate buildings, the same requirements as those for the main industrial rooms shall be imposed on

them. When gas treatment equipment is located in the attics, they shall be equipped as a technical floor.

12.2.20. The rooms housing gas treatment equipment shall be isolated and have no air communication with the main industrial rooms and zones. The entrance to and exit from such rooms shall be arranged through a separate air lock.

12.2.21 Isolated rooms or hermetic ventilated sections for repair, temporary storage of filters, devices, their components and for temporary storage of cleaning and decontamination agents shall be obligatory provided in buildings housing gas treatment equipment. A closed system for periodic regeneration shall be arranged for filtering self-treatment devices. Spent filters shall be transported in shielded containers in accordance with rules for radioactive cargo transportation.

12.2.23. An air supply system shall be provided for class I activities in zones 1 and 2. The supplied air shall have the radionuclide concentration not more than permissible values for air supply to hose-type individual protection means (pressure suites, pressure helmets, hose gas masks). The system shall have air distributors for simultaneous connection of not less than 2 hose-type individual protection means.

12.2.5. The entrances to the rooms where equipment for input ventilation is mounted shall be located outside the building or in a permanently-attended area.

12.2.14. A permanent exhaust ventilation system in storerooms, working rooms and boxes shall be provided for work involving emanating and volatile radioactive materials. The system shall be equipped with a redundant exhaust with the efficiency not less than 1/3 of the total design capacity.

12.2.24 For air supply to hose-type individual protection means, it is necessary to install a separate pneumatic line or individual input chamber equipped with fine aerosol filters or ventilators providing 500 mmH_2O in the hose/suit connection point, given airflow rate not less than 15 m^3 per suit.

12.2.25. The power networks for energy supply to hose-type individual protection means shall be made of corrosion-resistant materials. Hose connection places shall be provided with ball- or spring-type automatic valves.

12.2.26. Rooms where radioactive materials are used shall be water- or air-heated as required by construction codes and standards. Air heating combined with input ventilation systems shall be provided in rooms for class I and II activities.

2.2 [2.1.1] sets in detail some provisions of [1.2.3]. Below are extracts of the basic requirements from [2.1.1] (with the numeration of [2.1.1] Sections):

10.2 Ventilation systems of the strict-access area rooms of different categories (unattended, periodically-attended, permanently-attended) are prohibited to be linked by air ducts.

10.4. …. input-exhaust, exchange and process mechanically-driven ventilation systems shall be provided.

The number of ventilation systems shall be determined by the radiation and fire category of rooms and layout of rooms.

10.6 …. it is necessary to prevent the ingress of air released from ventilation pipes and process exhaust lines into air intake devices of the input ventilation systems.

10.7 The installation of coarse aerosol filters on the exhaust systems for strict-access area rooms is recommended to decrease the lifetime of fine aerosol filters of exhaust systems.

The filters of all input systems shall ensure not less than 80% effectiveness of air treatment from airborne radioactive particles.

10.8 ….air conditioning systems with positive air pressure shall be envisioned for permanently-attended rooms (control panels, operator's panels etc.) where stable conditions shall be maintained. The control boards shall be ventilated by self-supporting air conditioning systems.

The closed-mode operation of the air-conditioning system shall be provided in the event of emergency contamination of atmospheric air.

10.9 The ventilation units and filters of exhaust systems in the strict-access area shall be centralized in isolated rooms, which shall not be used as evacuation routes or personnel routes to equipment not related to ventilation systems.

10.10 The ventilators of the exhaust systems removing air contaminated with radioactive gases and aerosols shall be located, as a rule, in isolated rooms.

The drives and engines of the ventilation units shall be located, as a rule, in attended rooms…

10.11 The recirculation operation of ventilation systems intended for keeping health and safety air parameters is prohibited in permanently-attended and periodically-attended rooms of the strict-access area.

Recirculation ventilation units may be used for heating and air blanketing in exits for transport vehicles.

10.12. Self-contained air cooling systems, which are not connected with common air exchange systems maintaining health and safety air parameters, may be used for air cooling of rooms.

10.13 Recirculation ventilation systems may be used to maintain appropriate operating conditions of process equipment within containments and unattended rooms to be pressurized.

If necessary, recirculation systems shall provide for treatment of some part of the total air volume. The effectiveness of air treatment shall ensure controlled radiological conditions in ventilated rooms.

10.14 If enclosures of containments and unattended rooms to be pressurized have metal lining, the ventilation systems in these rooms shall maintain negative pressure no less than 200 Pa (20 kgf/m^2) relative to permanently-attended rooms.

If there is no metal lining in unattended rooms to be pressurized, negative pressure no less than 100 Pa (10 kgf/m^2) may be permitted.

In unattended rooms not to be pressurized and periodically-attended rooms, the ventilation systems shall maintain negative pressure no less than 50 Pa (5 kgf/m^2).

10.20 If air is supplied directly to periodically-attended rooms, they shall be ventilated with 20% excess of the removed air as compared with supplied air.

10.21 Self-supporting input systems with aerosol or iodine filters in the event of emergency contamination of outdoor air shall be provided for control rooms.

10.22 Exhaust and input systems covering rooms of the strict-access area shall have redundant ventilation units, devices for their automatic actuation.

Redundant treatment equipment shall be provided on exhaust ventilation systems ensuring pre-release air treatment.

10.24 Fast-acting isolation valves shall be installed within rooms and outside the containment on air ducts of ventilation systems for normal operating conditions in containments or unattended rooms to be pressurized.

Two safety isolation valves may be installed only outside the containment on air ducts of periodically-operating systems. The air ducts of ventilation systems shall withstand the pressure to be provided in the rooms.

10.25 The fast-acting isolation valves installed on air ducts of ventilation systems shall be closed upon pressure increase within containments and unattended rooms to be pressurized if the performance of these ventilation systems is not required to confine the accident.

10.26 Air ducts of exhaust and input systems shall be made of material with respect to explosion and fire safety requirements. Air ducts of ventilation systems, control and isolation valves, compression devices of filters shall be provided with corrosion-resistant coating selected with regard to corrosiveness and temperature of transported air.

10.31 The filtering stations shall be provided with devices to determine the effectiveness of air treatment by exhaust systems.

10.32 Spent filters shall be replaced and transported with use of shielded containers.

10.46 The ventilation systems intended for unattended rooms to be pressurized and fast-acting isolation valves installed on the systems shall be controlled and monitored remotely from the main control room (MCR).

The ventilation systems intended for unattended rooms not to be pressurized, periodically-attended and permanently-attended rooms shall be controlled and monitored from the central ventilation control board. In addition, in situ control of these systems shall be envisioned.

10.47 MCR remote control of air temperature and negative pressure shall be envisioned for unattended room to be pressurized.

Monitoring of air temperature shall be ensured in rooms of the strict-access area with potential for heat release, and so shall be monitoring of negative pressure if radioactive contamination is expected.

Instrumentation shall be located on the observation board or installed directly at rooms.

10.50 The ventilation systems covering radiation-hazardous rooms and the duct shall be provided with air flow rate control devices.