

Methodological Framework for Risk Assessment in the Russian Federation

UNECE Seminar on Risk Assessment Methodologies

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Dr. Sci. Tech.

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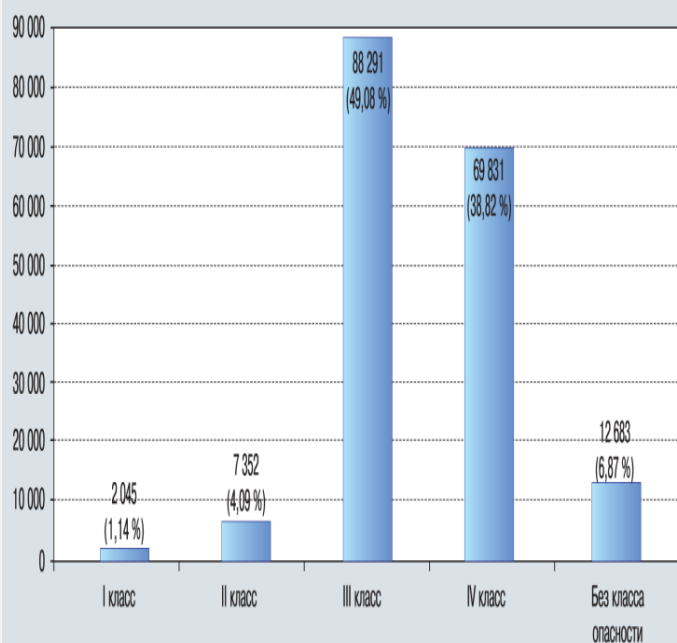
STC “Industrial Safety” CJSC

д.т.н., директор Центра анализа риска ЗАО ИТЦ ПБ

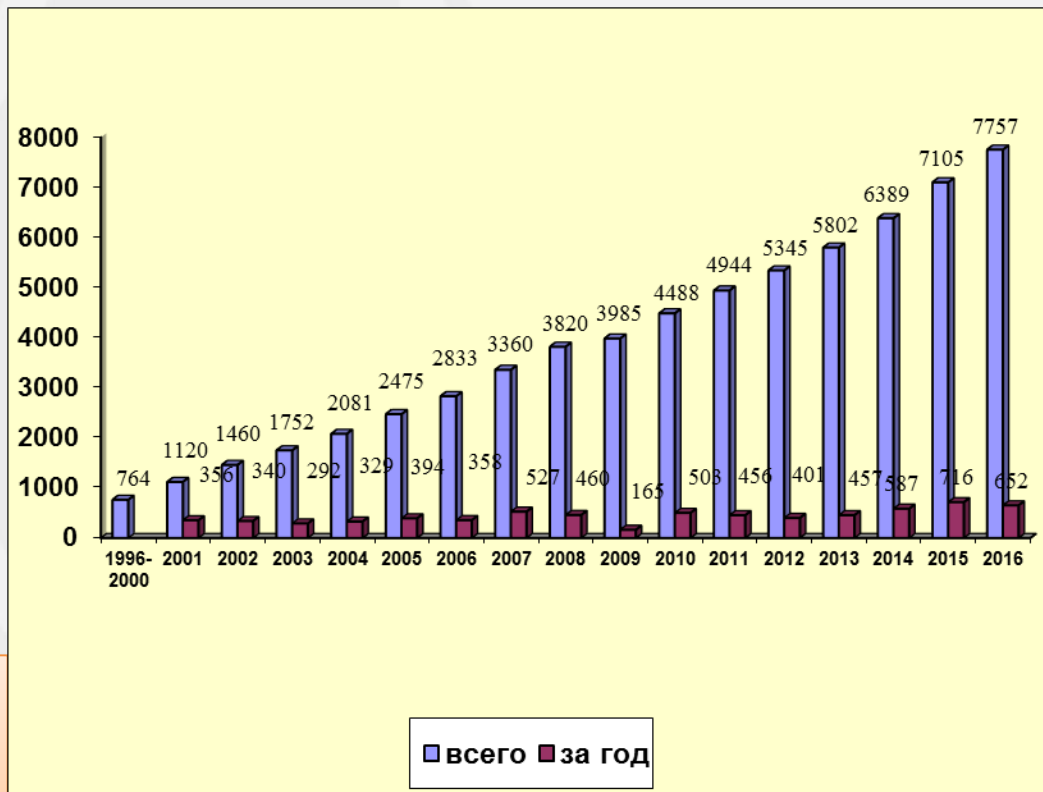
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The most complete quantitative risk analysis presented in the industrial safety declarations of hazardous production facilities (the analogue of the Safety Report on Seveso Directives No. 96/82/EC)



**Total registered 180 000 HPF, including a 5.2%:
I class-2 thousand HPF,
II class - 8 thousand HPF**



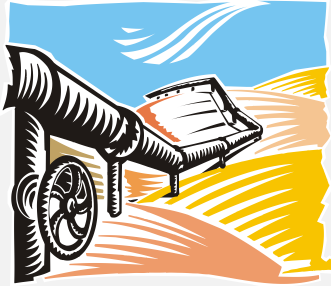
Summarized information on the progress of declaring industrial safety of HPF (1996-2016)

Минимальные размеры страховых сумм в зависимости от рассчитанного количества потерпевших

Minimum Sums Insured depending on the calculated number of victims

Для декларируемых: For declared objects

6,5 млрд \bln	- max кол-во потерпевших \number of suffered> 3000 чел.\pers.
1 млрд.\bln	- max кол-во потерпевших \number of suffered 1500 - 3000 чел.\pers.
500 млн.\mln	- max кол-во потерпевших \number of suffered 300 - 1500 чел.\pers.
100 млн.\mln	- max кол-во потерпевших \number of suffered 150 - 300 чел.\pers.
50 млн.\mln	- max кол-во потерпевших \ number of suffered 75 - 150 чел.\pers.
25 млн\mln	- max кол-во потерпевших \number of suffered 10 - 75 чел.\pers.
10 млн.\ mln	для иных объектов\for other objects

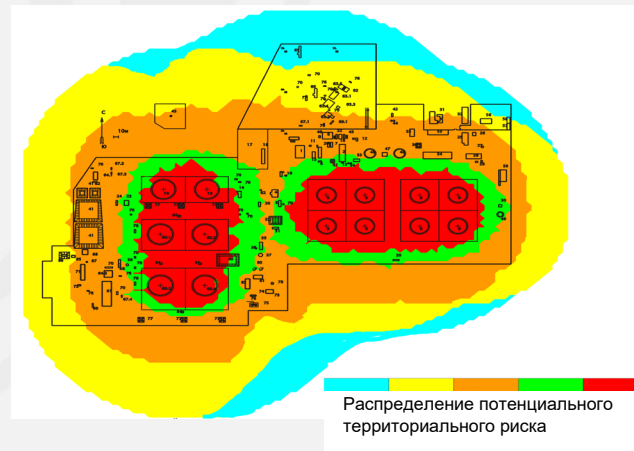
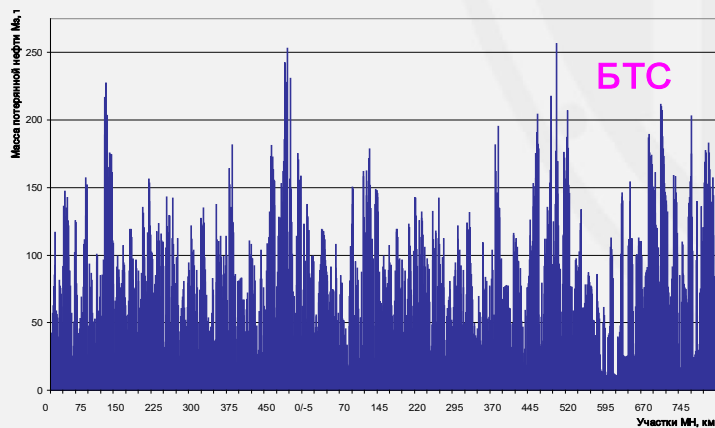
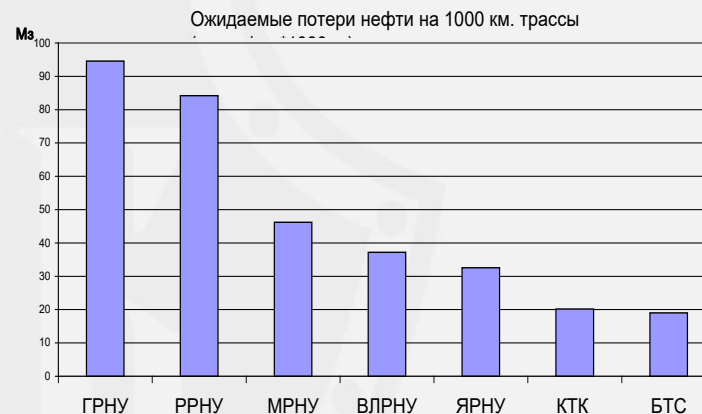
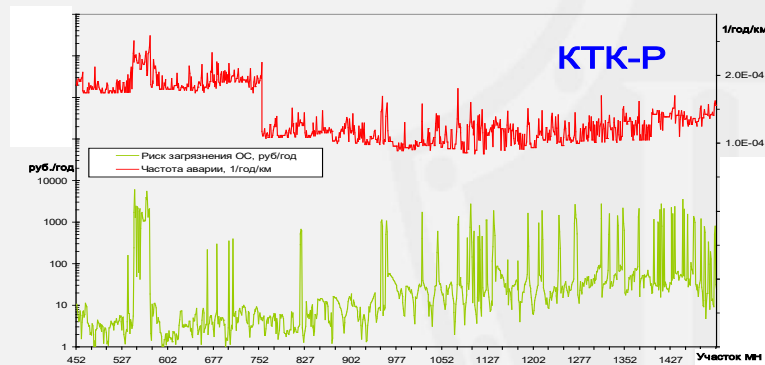


Для не декларируемых объектов:\For non declared objects

50 млн.\ mln	ОПО химии, нефтехимии, нефтепереработки.\HTF of chemistry, petro-chemistry and oil refining
25 млн. \mln	сети газоснабжения и газопотребления\gas supplied and gas distribution systems
10 млн.\ mln	для иных объектов\for other objects



Оценка показателей риска аварий, выявление «слабых» мест и сравнительный анализ. /Assessment of Accident Risk Indices, Identification of «weak» points and comparative analysis.



Methodical normative documents on conducting risk analysis in Russia

- **Rostekhnadzor:**
Federal regulations and rules in the field of industrial safety
(mandatory)
Safety guides *(recommendations)*
- **EMERCOM of Russia:**
Methods of calculation of fire risk *(mandatory)*
Standards in the field of prevention and risk assessment of emergency situations *(recommendations)*
- **National standards GOST R**
- **Standards of enterprises: Gazprom, Transneft, LUKOIL, etc.**

Risk Analysis Methodology in Russia is Harmonized with Foreign Approaches

standards IEC (МЭК), ISO (ИСО), Norsok, methodical documents TNO, DNV GL, Shell, Exxon,

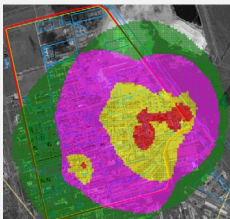
are reflected in the Russian standards GOST R /ГОСТ Р 51901.1-2002 IEC (МЭК 60300-3-9), ГОСТ Р 51897-2011/ ГОСТ Р ИСО/МЭК 31010-2011, ГОСТ Р ИСО 17776-2010, ГОСТ Р 51901.11-2005 (МЭК 61882:2001), ГОСТ Р МЭК 61508, ГОСТ Р МЭК 61511, methodical documents Ростехнадзора, МЧС and the company ПАО «Газпром», ПАО «Транснефть» , etc.

Accident RISK – hazard measure characterizing the *possibility* of accident occurrence at hazardous production facility and *severity of its consequences*

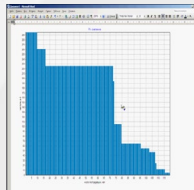
RISK ANALYSIS — process of identification of hazards and risk assessment of an accident at hazardous production facility for individuals or groups of population, property or environment.

Software for accident impact assessment and calculation of risk indicators

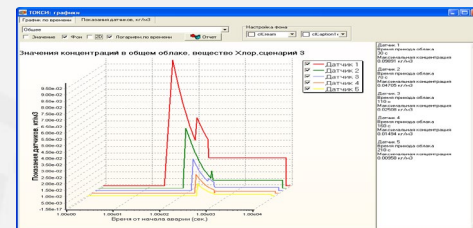
Series **TAXI+** (STC "Industrial Safety" CJSC, Russia):



TAXI+
Risk



TAXI+
Гидроудар



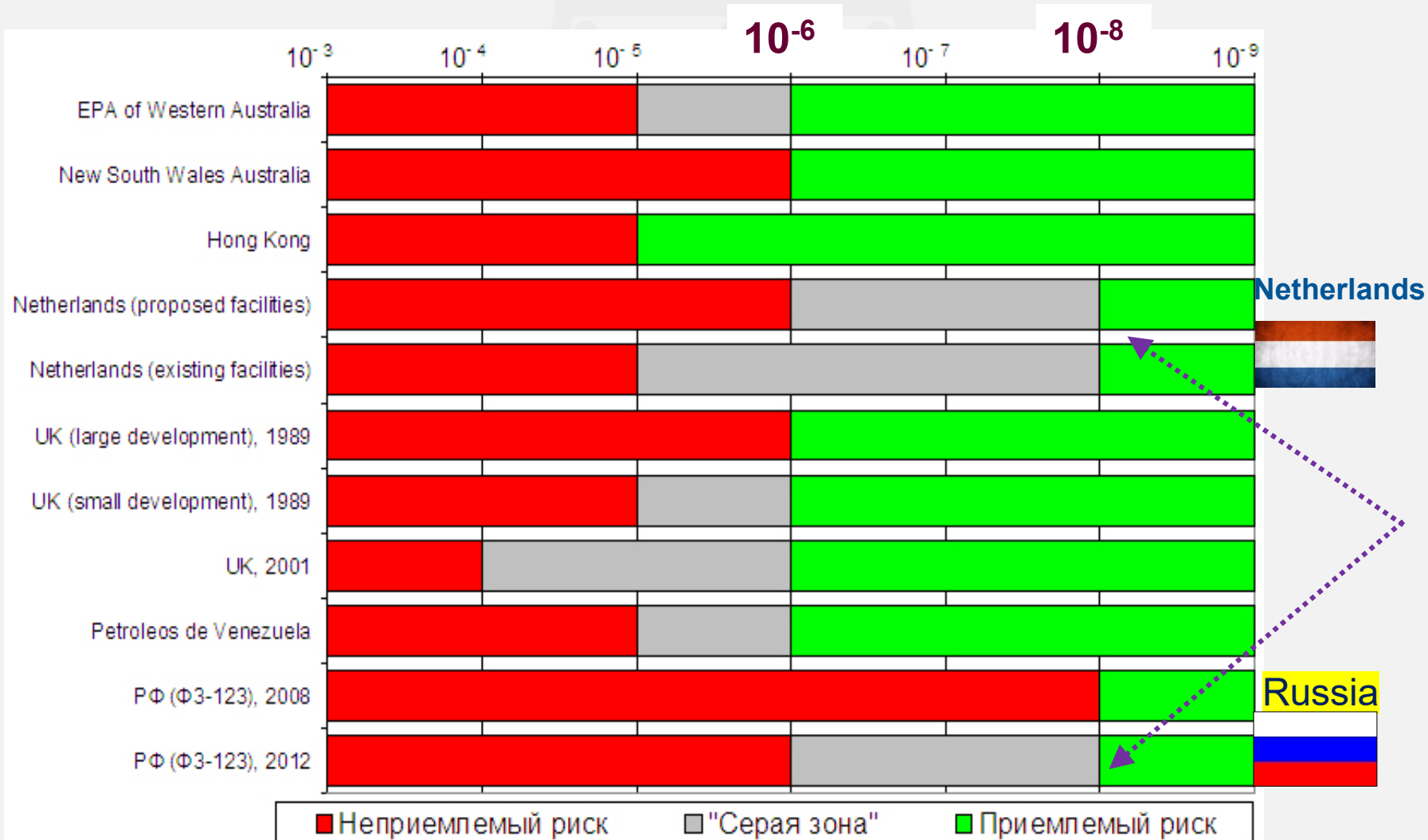
TAXI+
HAZOP

TAXI+
Meteo

Software tools for **Computational Fluid Dynamics (CFD)**
FLACS (GexCon, Norway)



Acceptable risk criteria in different countries (for population)





Tolerable (Acceptable) Risk Assessment

Federal Law «Technical Reglament on Fire Safety Requirements» Article 93.

Regulatory value of production facilities fire risk

... Value of individual fire risk :

shall not exceed 10^{-6} per year in the buildings, facilities, structures and on the territories of production facilities (... 10^{-4}).

... shall not exceed 10^{-8} per year for people located at the residential area near the facility.

Value of social fire risk for people located at the residential area shall not exceed 10^{-7} per year.

Average Statistical Data of Russia

Risk of fatality for any reason	$1,60 \times 10^{-2}$ per year ⁻¹
Risk of fatality at natural disaster	$1,87 \times 10^{-7}$ per year ⁻¹
Risk of fatality in aircraft crash	$4,30 \times 10^{-7}$ per year ⁻¹
Risk of fatality at fire	$7,4 \times 10^{-5}$ per year ⁻¹
Risk of being murdered	$2,73 \times 10^{-4}$ per year ⁻¹
Risk of fatality in car accident	$2,2 \times 10^{-5}$ per year ⁻¹
Risk of fatality because of accidental poisoning with alcohol	$2,97 \times 10^{-4}$ per year ⁻¹

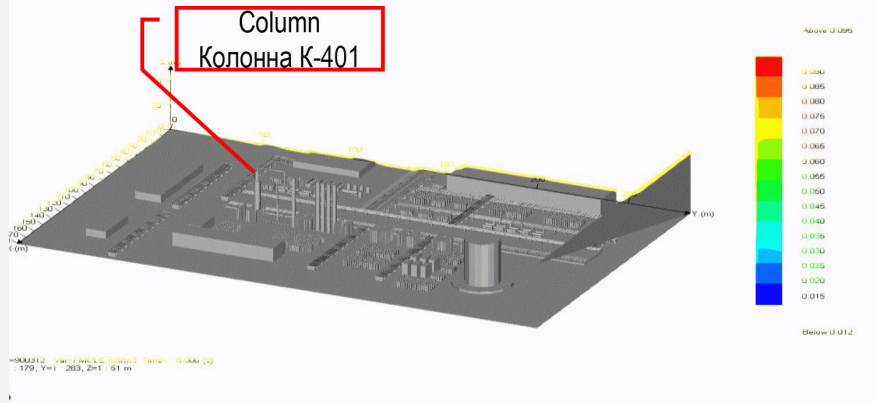
The difference between the Russian methodologies from the foreign

related to:

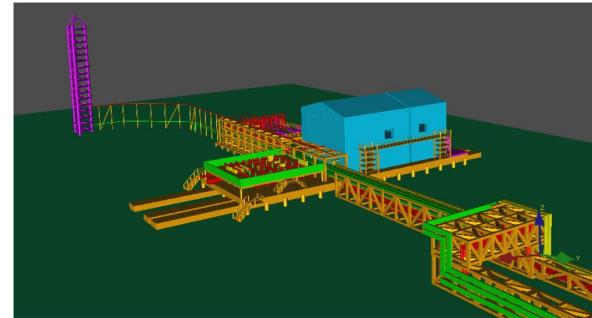
- 1) **application of individual terms, criteria of exposure, for example, on consequences of explosions of clouds of fuel and air mixtures;**
- 2) **assumptions used in practice** (for example, in foreign practice the scenarios with complete destruction of LPG tanks are not calculated);
- 3) **absence in Russia:**
 - **databases on equipment reliability, incidents and accidents** (except for trunk pipelines);
 - **software for simulation of emergency emissions and explosions in 3D geometry** (analog of GexCon FLACS).

CFD-simulation of emergency emissions and explosions: FLACS (Gexcon)

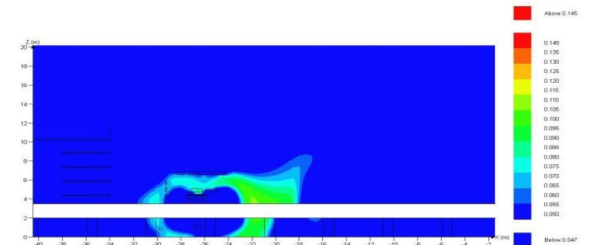
Accident at Achinsk Refinery /Авария на Ачинском НПЗ 15.07.2014:



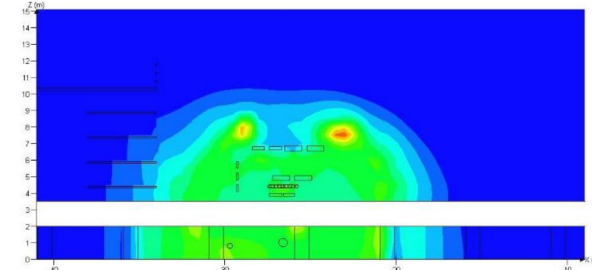
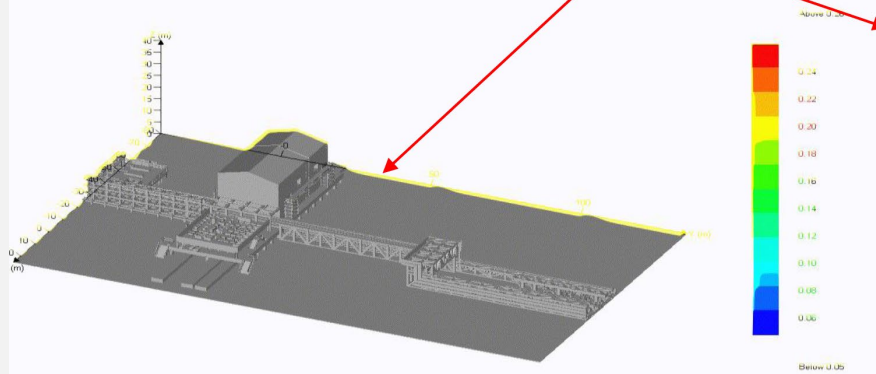
HPF basic model Исходная модель ОПС



Distribution $P(z,x)$: Распределение $P(z,x)$:

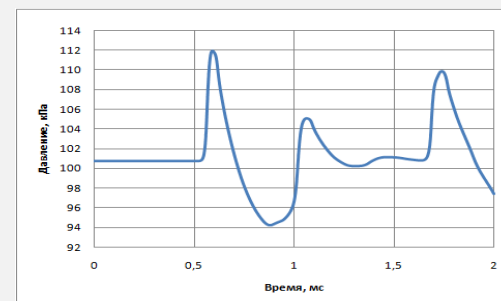
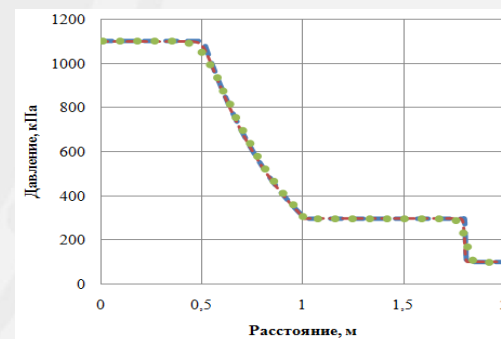
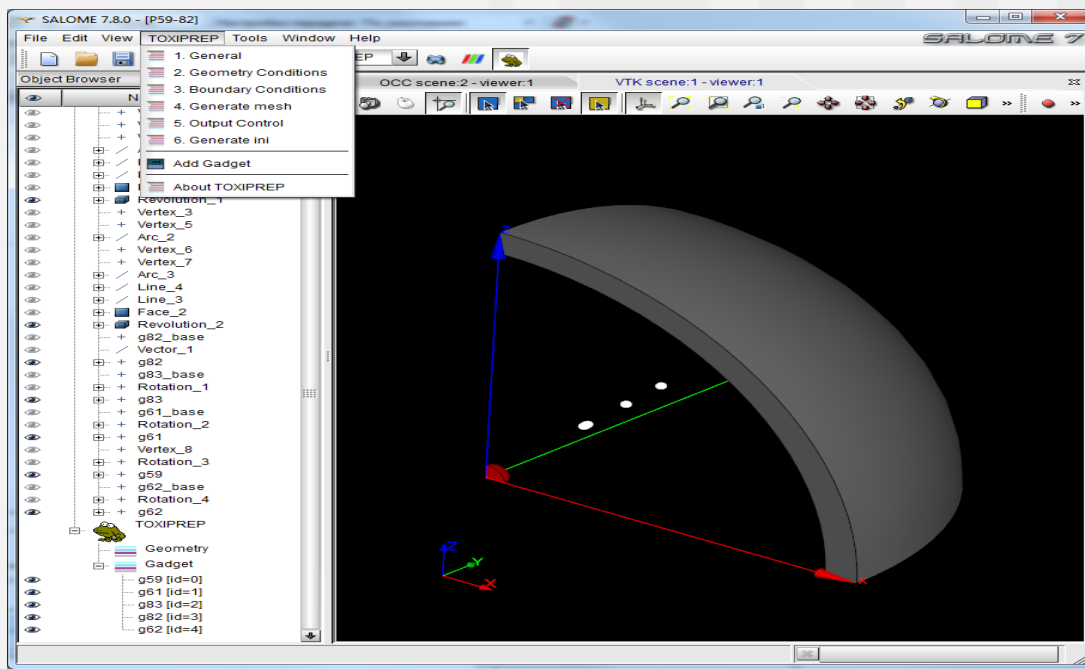


Possible accident at CS (gas emission)
Возможная авария на КС (выброс газа):

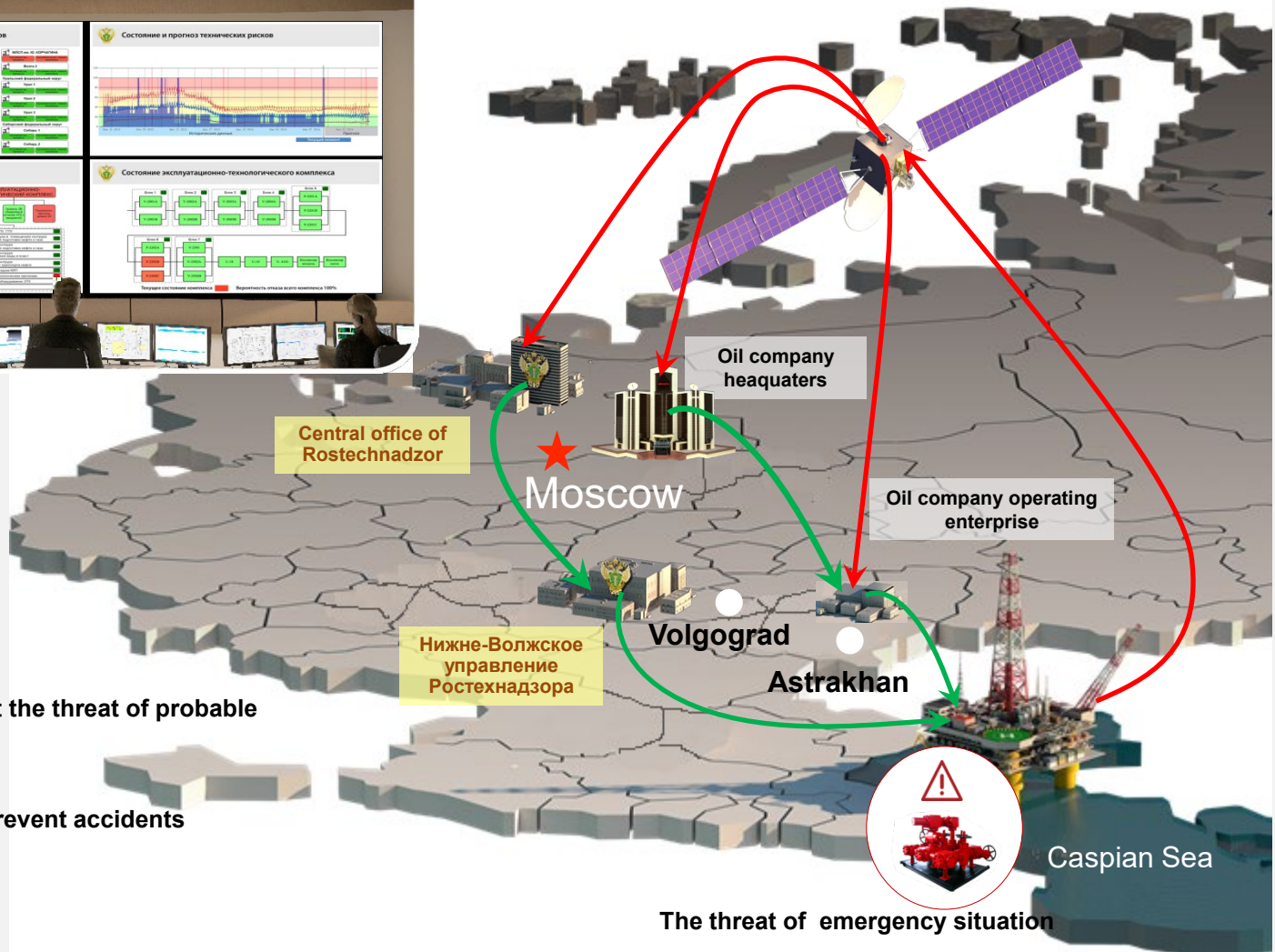
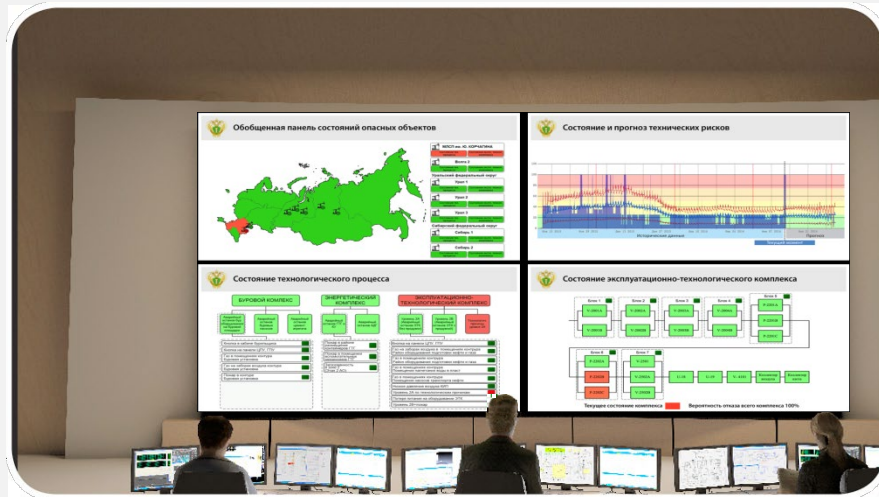


Development of the SG draft “Methodology for calculating the consequences of accidental emissions and explosion of fuel-air mixtures in the conditions of real geometry of the surrounding space” (based on CFD- *Computational Fluid Dynamics*)

**Goals: computer program for calculating dispersion of emergency emissions and explosion parameters in 3D geometry, which is as good as the program FLACS of Norwegian company GexCon.
Developer: STC “Industrial Safety” CJSC**



Scheme of response to deviations from the standard process conditions



← Sending a signal about the threat of probable accident

← Taking measures to prevent accidents

Thanks for attention!

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