Appendix

●Presentation Documents

Japan's cooperation to Russia in the field of dismantlement of decommissioned nuclear submarines and other related projects

By Issei Nomura
Japanese Representative in the Governing Council of the Japan-Russia Committee

June 7. 2005

A Brief History

Oct '93	:	Conclusion of Agreement on Japan-Russia Cooperation to Assist the Destruction of Nuclear Weapons Reduced in the Russian Federation
Nov '01	:	Low-Level Radioactive Liquid Waste Processing Plant "Suzuran" Completed
Jun '02	:	G8 Global Partnership established
Jan '03	:	Prime Minister Koizumi's Visit to Russia and Adoption of the "The Japan-Russia Action Plan"
Feb '03	:	Japan-Russia Bilateral Resolution to Dismantle One Victor III Class Nuclear Submarine
Jun '03	:	Implementing Arrangement Concluded
Dec '03	:	Related Contracts Concluded and Cooperation on the Project Started
Dec '04	:	Victor III Class Nuclear Submarine Dismantlement Project Completed
Present	:	Discussing on Cooperation to Dismantle 5 Nuclear Submarines, including a Victor I Class

Future Plan

Based on Discussions with Russia:

- Continuing cooperation with the dismantling of decommissioned nuclear submarines near Vladivostok;
- Another five nuclear submarines to be dismantled (Negotiation on an Implementing Arrangement for the project is under way).

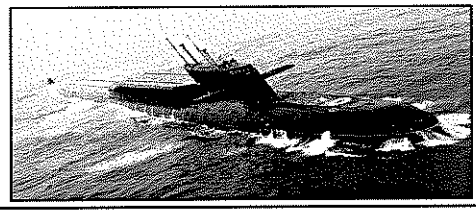
Particular interest

- Importance of the public awareness of the necessity of the dismantlement of nuclear submarines in Russia.
- Necessity to obtain enough information and to have adequate access.
- Importance of safety measures for the dismantlement of submarines.
- Simultaneous dismantlement both in the Far East and in the North West.

Peculiarities of International Cooperation within the Framework of the Global Partnership in the Far East Russia

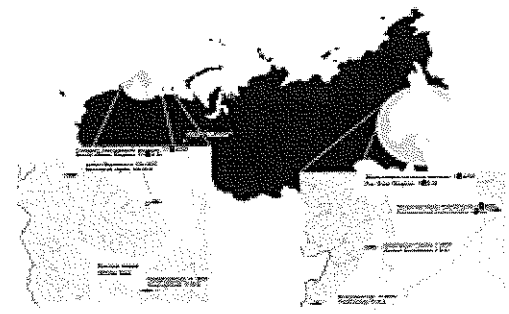
S.V. Antipov

Deputy Director
Federal Atomic Energy Agency
Russian Federation



1

Russian Regions Concerned with Complex Decommissioning and Environmental Rehabilitation Tasks



2

Generalized Data on the Activity Accumulated in Russian Regions at Complex Decommissioning Facilities

Region	SNF, Bq	SRW, Bq	LRW, Bq
Murmansk region	$3\cdot10^{17}$	$2\cdot10^{16}$	$8\cdot10^{12}$
Arkhangelsk region	$4\cdot10^{16}$	$9\cdot10^{14}$	$8\cdot10^{11}$
Σ Northwest Russia	$3.4\cdot10^{17}$	$2.1\cdot10^{16}$	$8.8\cdot10^{12}$
Primorskiy kray	$2\cdot10^{17}$	$7\cdot10^{15}$	$2\cdot10^{12}$
Kamchatka	$5\cdot10^{16}$	$4\cdot10^{15}$	$2\cdot10^{12}$
Σ Far East Russia	$2.5\cdot10^{17}$	$1.1\cdot10^{16}$	$4\cdot10^{12}$
TOTAL:	$5.9\cdot10^{17}$	$0.3\cdot10^{17}$	$0.0001\cdot10^{17}$
Ratio	94%	6%	<0.01%

3

Ultimate Goals of Nuclear Submarine Complex Decommissioning

- Safe unloading of nuclear materials (SNF) and their removal from regions to "Mayak";
- Environmentally safe cutting of NS end compartments with insulation of toxic and other noxious waste; radioactive waste separation and management up to a condition allowing its reliable ultimate disposal;
- Making up Reactor Compartment (RC) units, placing most of SRW generated during NS cutting therein and RC unit installation at Long-term Storage Facility (LSF) for long-duration hold up.

After 70 – 100 years of hold up at LSF the activity of RC units will decrease down the levels allowing their dismantlement and subsequent reuse of the most of metal without limitations. The rest of radioactive materials will be ultimately disposed.

4

Actual Status of Funding of International Projects Related to NS Complex Decommissioning, SNF and RW Management and Rehabilitation of Former Naval Coastal Maintenance Bases, as of 01.01.05 (US $ million)

№	Country	Total declared pledge to the Global Partnership	For NS complex decommissioning and coastal maintenance base rehabilitation	Amount under concluded contracts
1	USA	10000	not determined	86.0
2	Canada	800	258	19.3
3	UK	750	200	31.4
4	Germany	1900	380	109.7
5	France	975	not determined	0.14
6	Italy	1300	430	-
7	Japan	200	100	6.7
8	EU	1300	not determined	-
9	Norway	130	130	22.6
10	Sweden	33	not determined	1.1
11	Australia	7	7	-
12	Netherlands	not determined	12	-
13	Belgium	0.65	0.65	-
14	Russia	2000	600	266
TOTAL:		19395.65	2109.65	542.9

5

Problems of NS Complex Decommissioning in the Far East Russia

- Lack of on-shore Long-term Storage Facility (LSF) for reactor compartments;
- Insufficient information on SNF and RW condition at coastal maintenance bases;
- Need for special approaches to solution of the problem of complex decommissioning of 2 damaged NSs;
- Lack of a SRW conditioning and processing facility;
- NS complex decommissioning in Kamchatka and RC transportation to Primorskiy kray;
- Lack of a system for toxic and noxious substance handling;
- No way of performing decommissioning of nuclear maintenance vessels;
- No way of SNF removal from FEP "Zvezda" by rail way;
- Lack of attention of the Global Partnership's participants to the Far East region of Russia;
- Lack of regional monitoring system.

6

Foreign Affairs Canada
Global Partnership Program (GPP)
Submarine Dismantlement Program

カナダ外務省
グローバル・パートナーシップ・
プログラム (GPP)
潜水艦解体プログラム

Overview and Status June 6, 2005
概要と現況(2005年6月6日)

GPP Submarine Dismantling Program/Project

- $300m CAD Declared Program
- Two Projects totaling $152m CAD currently being implemented 2004-2008:
  - Bi-lateral Project $120m for Russian Nuclear submarine dismantling with FSUE Zvezdochka
  - Multilateral project $32m for nuclear clean-up and related nuclear infrastructure via EBRD
- $148m* submarine dismantling project(s) 2008-2013 awaiting definition and approval

* Actual Funding for program may be adjusted to address departmental funding shortfalls

Nuclear Submarine Dismantling Project 2004-2008

- Dismantle 12 Nuclear powered submarines
- Project start: July 7, 2004
- Project Termination: March 31, 2008
- Broad Scope: Towing. Complete defueling. Dismantling of fore and after ends. Related minor infrastructure improvements.

Project Fiscal Framework

- Contribution Agreement based approach to provide the basis for an "Implementing Arrangement" under the....

AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF THE RUSSIAN FEDERATION CONCERNING COOPERATION ON THE DESTRUCTION OF CHEMICAL WEAPONS, THE DISMANTLEMENT OF DECOMMISSIONED NUCLEAR SUBMARINES AND NUCLEAR AND RADIOACTIVE MATERIAL PROTECTION, CONTROL AND ACCOUNTANCY

Signed G8 Sea Island Summit June 4, 2004

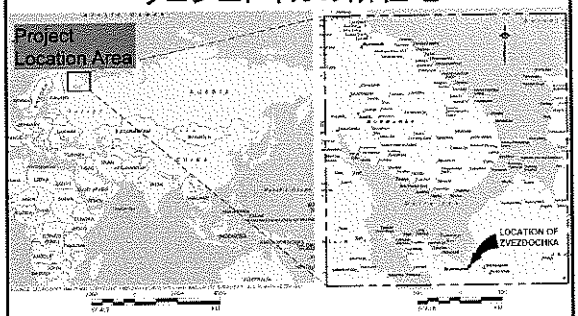
Contribution Arrangement #1

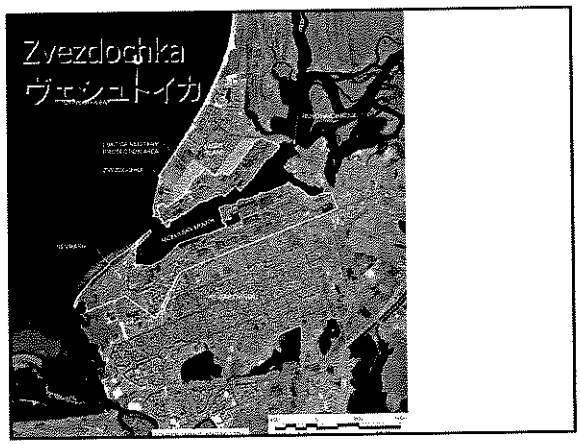
- Effective July 30, 2004 – August 31 2005
- Towing of: VICTOR Class III NPS Hull # 643 and 645
- Defueling and Dismantling of:
  - VICTOR Class I NPS Hull # 608
  - VICTOR Class III NPS Hull # 643
  - VICTOR Class III NPS Hull # 645
- Improvements to concrete pad area by Harris Sheers

Contribution Arrangement #2

- Effective April 4, 2005 – June 30, 2006
- Towing of: VICTOR Class NPS Hull # 641, 652, 605, 635, 649, 655, 657, 609
- Dismantling and defueling of:
  - VICTOR Class I NPS Hull # 605
  - VICTOR Class III NPS Hull # 641
  - VICTOR Class III NPS Hull # 652
- Defueling only of VICTOR Class III NPS 636
- Expansion of concrete pad area by Harris Sheers

Zvezdochka Location
ヴェシュトイカの所在地



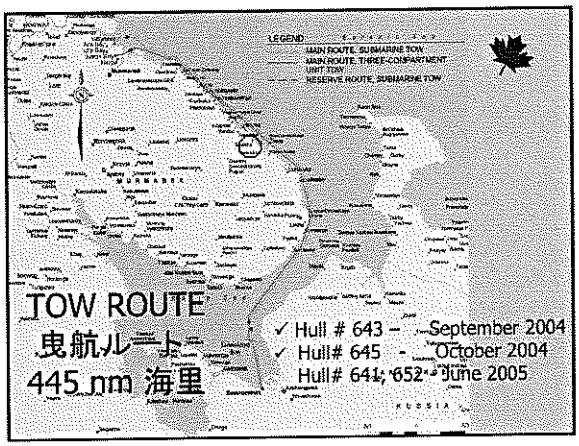


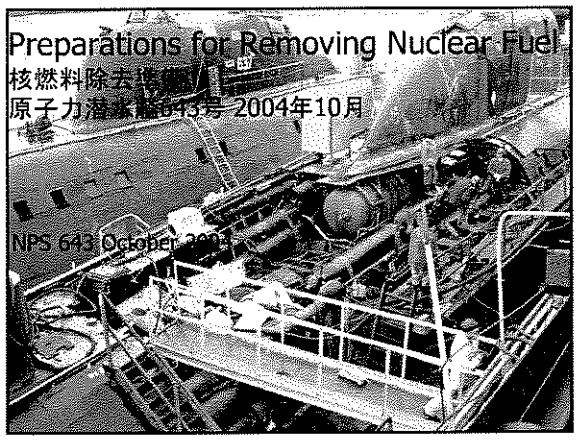
Project Management Structure

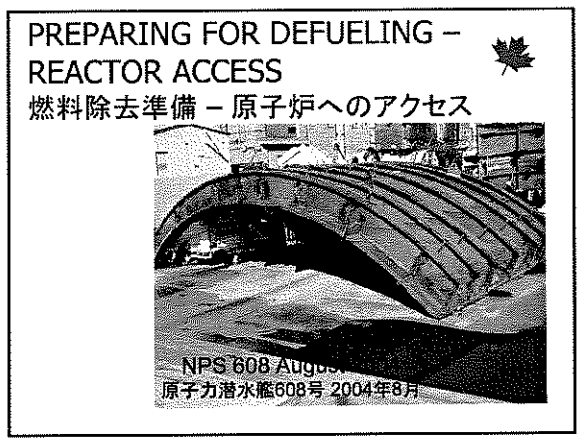
- Foreign Affairs Canada – Project Manager
- Teledyne Brown Engineering
  テレダイン・ブラウン・エンジニアリング (*Technical Monitoring Services and Negotiation Support*) with Sub Contractors:
  - ケロッグ・ブラウン&ルート・サービス
    (KBR: Kellogg Brown & Root Services, Inc.)
  - デボンポート・ロイヤル・ドックヤード
    (DML Devonport: Devonport Royal Dockyard Limited)
  - マリン・ヘビー・リフト・パートナーズ
    (MHLP: Marine Heavy Lift Partners BV)
  - ニュークリア・セイフティ・ソリューションズ
    (NSS: Nuclear Safety Solutions Ltd)
  - プロジェクト・マネジメント・センター
    (PMC: Project Management Centre)

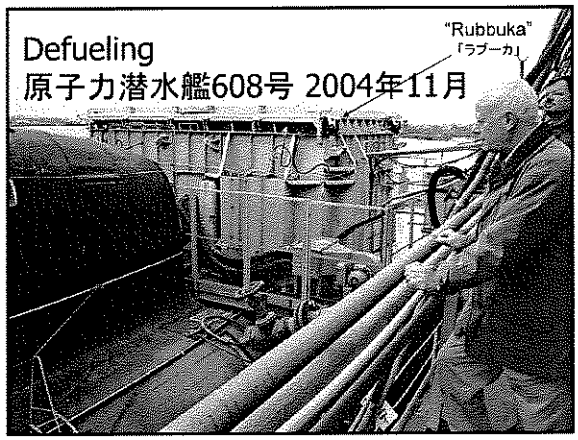
Technical Monitoring.....

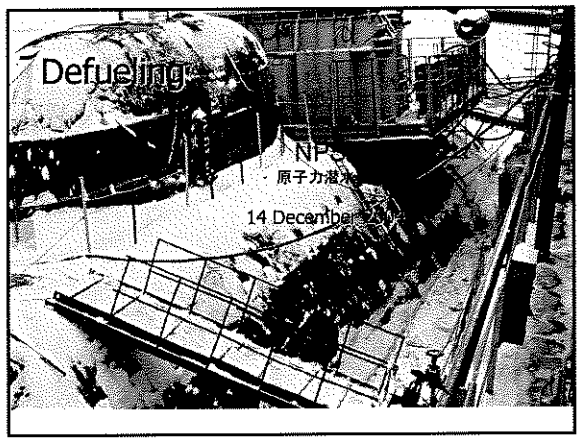
- Site visit to FSUE Zvezdochka every 28 days (approx)
- Minimum two GPP representatives ('two man rule')
- Monitoring visit example activities:
  - Visit each submarine, three-compartment unit, etc.
  - Review status of work completed and Milestones claimed
  - Visit Liquid Radioactive Waste, Solid Radioactive Waste & hazardous waste handling facilities
  - Witness/confirm Spent Nuclear Fuel handling operations
  - Review of environmental monitoring activities
  - Review of permitting & licensing documentation
  - Review of scrap metal processing documentation
  - Visit/inspect infrastructure project
- Formal monthly report as the basis for shipyard payment (usually with 14 days of site visit)




Preparations for Removing Nuclear Fuel
核燃料除去準備
原子力潜水艦643号 2004年10月
NPS 643 October 2004


PREPARING FOR DEFUELING –
REACTOR ACCESS
燃料除去準備 – 原子炉へのアクセス
NPS 608 Aug
原子力潜水艦608号 2004年8月

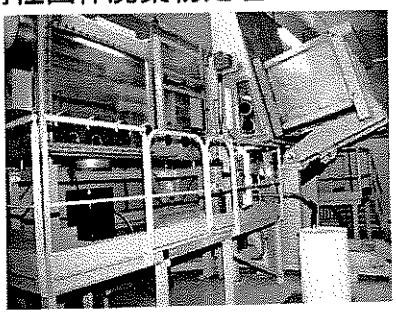

Defueling
原子力潜水艦608号 2004年11月
"Rubbuka"
「ラブーカ」


Defueling
NPS
原子力潜水
14 December


NUCLEAR FUEL LOADING
OF NPS 608 FUEL - DECEMBER 2004
原子力潜水艦608号の核燃料を移送のために積み込み
2004年12月

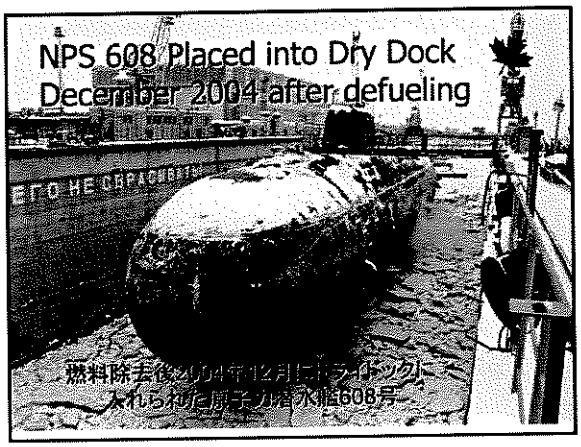

Liquid Radioactive Waste Handling
放射性液体廃棄物処理

Solid Radioactive Waste Handling
放射性固体廃棄物処理



Solid Radioactive Waste Handling
放射性固体廃棄物処理

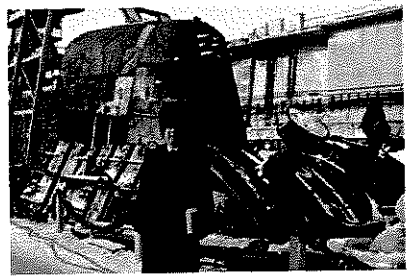
NPS 608 Placed into Dry Dock
December 2004 after defueling



燃料除去後2004年12月にドライドックに
入れられた原子力潜水艦608号

Dismantling NPS 608....
原子力潜水艦608号の解体....

2005年3月

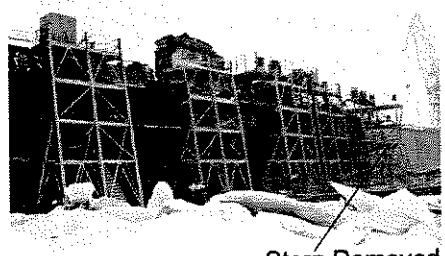


March 2005

NPS 643 transferred to dock basin
March 2005 after defueling

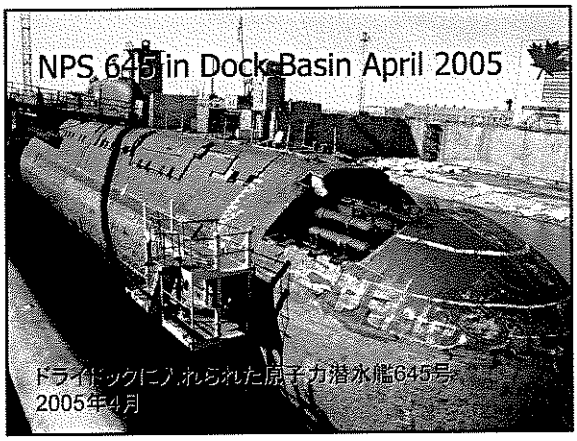
燃料除去後2005年3月に
ドライドックに移動された原子力潜水艦643号

NPS 643 April 2005
Rapid Progress 迅速な作業進行



Stern Removed
船尾は撤去済み

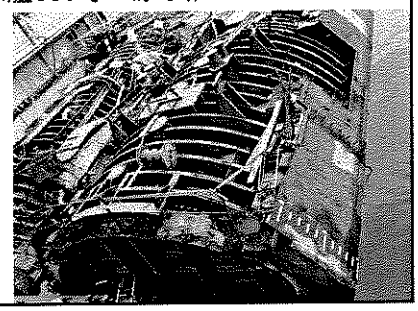
NPS 645 in Dock Basin April 2005



ドライドックに入れられた原子力潜水艦645号
2005年4月

NPS 608 as a Three Compartment Unit May 2005

原子力潜水艦608号の原子炉モジュール
2005年5月



CONTRIBUTION FUNDING STATUS May, 2005

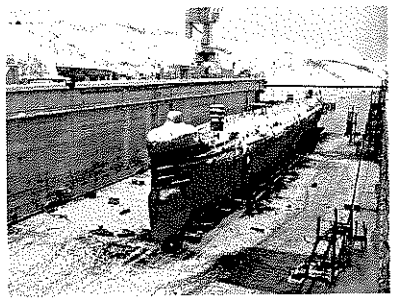
Total Contribution Funds IA#1:	$24,353,341	総拠出額
Total Contributions To Date (62%):	$15,134,179	現在までの拠出額
Unexpended Contributions	$ 9,220,162	未拠出額:

資金拠出状況 2005年6月

Summary

- Canada is engaged in dismantling 12 Russian nuclear submarines in FSUE Zvezdochka
- Project started August 2004
- 3 Submarines are in an advance stage of dismantling (following defueling) June 2005
- 7 Submarines will be defuelled by March 2006
- 6 Submarines will be dismantled by June 2006

EWN



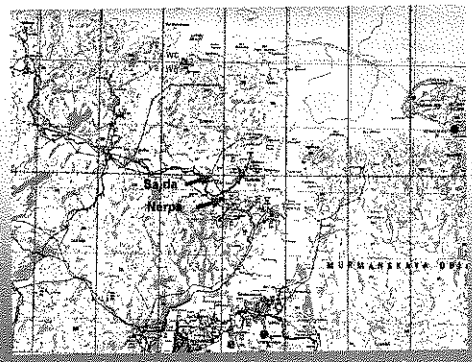
German support for the dismantlement of nuclear submarines in Russia

EWN

- Decision of the G8 for Global Partnership
- Aim: support of Russia in disarmament and fight against terrorism
- German contribution over a period of 10 years up to 1.5 billion US-$
- President Putin sets priorities:
  - dismantling of submarines
  - destruction of chemical weapons
- Task of EWN: dismantling of about 120 submarines in the North-West of Russia

German support in dismantling nuclear submarines in Russia

EWN



EWN

Strategic role of the project :

Starting position:

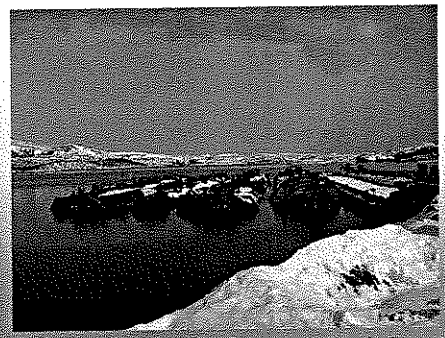
- In the North-West Region Russia dismantled already about 50 nuclear submarines partly
- They are unsafely stored afloat in the Sayda Bay. 8-10 sections consisting of 3 compartments are added per year
- Further 70 decommissioned nuclear submarines with nuclear fuel have to be disposed
- Decommissioned submarines with nuclear fuel on board are a large potential of nuclear danger and endanger the environment

Solution:

- Erection of a central onshore interim storage facility for storage of 120 reactor compartments from nuclear submarines in the Sayda Bay

German support in dismantling nuclear submarines in Russia

EWN



Reactor compartments afloat in the Sayda Bay

EWN

Agreement

between the Federal Ministry of Economics and Labor Of the Federal Republic of Germany

and the Ministry for Atomic Energy of the Russian Federation

for

support

for the elimination of the nuclear weapons which are to be reduced by the Russian Federation through the dismantlement of decommissioned nuclear submarines from Russia's Fleet

within the framework of the initiative Global Partnership against the spread of weapons and materials of mass destruction

(signed on 9 October 2003 in Yekaterinburg)

German support in dismantling nuclear submarines in Russia

Subject of the Project

Article 1: „(1) ...

1. Erection of an onshore long-term interim storage facility for reactor compartments in the Sayda Bay, including respective infrastructure;
2. Optimization of the material and technical situation and of the equipment of Russian companies, in order to accelerate disposal of nuclear submarines;
3. Establishing of conditions for a safe handling of waste products, generated in the disposal of nuclear submarines in the northern region of the Russian Federation;
4. Creation of an ecologically sound status of the environment in the Sayda Bay."

German support in dismantling nuclear submarines in Russia

Legal aspects of the German-Russian Agreement for disposal of Russian nuclear submarines

- Reference to the German-Russian governmental agreement on disarmament of 16 December 1992 (disarmament) in the items
  - general (aid in disarmament)
  - liability
  - customs and tax exemption
  - access to military zones

German support in dismantling nuclear submarines in Russia

Legal aspects of the German-Russian Agreement for disposal of Russian nuclear submarines

- Reference to the more modern framework agreement of 21 May 2003 for the Multilateral Nuclear Environment Program in the Russian Federation (MNEPR)
  - general
  - liability
  - customs- and tax exemption
  - access

Preliminary use (article 10, para. 1 of the interministerial agreement) until entering into force of the MNEPR-agreement for the Federal Republic of Germany and the Russian Federation!

German support in dismantling nuclear submarines in Russia

Single legal aspects:

- Customs and tax exemption for German aid
  - The interministerial agreement refers to Art. 9 of the MNEPR-agreement (exemption from tax and other duties)
  - Until now only positive experiences in financing Russian contractors

German support in dismantling nuclear submarines in Russia

Single legal aspects:

- Questions of liability
  - The interministerial agreement refers to Art. 6 of the governmental agreement of 16 December 1992 as well as to the protocol of the MNEPR-agreement
  - The special German-Russian liability agreement of 1998 is not referred to, since nuclear equipment according to the area of applicability of the mentioned agreement is not delivered (only civil goods)

German support in dismantling nuclear submarines in Russia

Single legal aspects:

- Access of the German personal to the project sites of the agreement in Russia
  - Neither the governmental agreement of 16 December 1992 nor the MNEPR- agreement (Art. 6, 10) do reliably regulate the access of the German side to the places of fulfillment
  - Both project sites – Nerpa-shipyard (dismantling) and Sayda Bay (interim storage facility) – are located in a military zone.

Regulated access for the German side is a prerequisite for effective cost control and project management!

German support in dismantling nuclear submarines in Russia

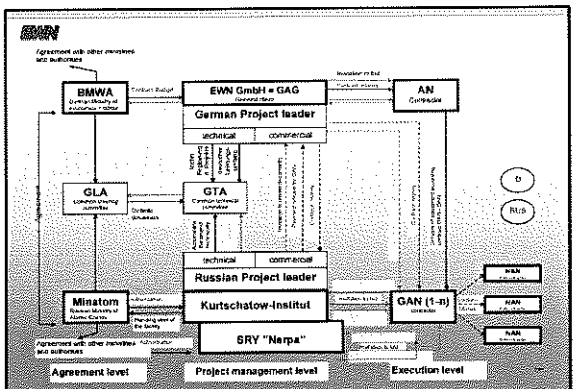
EWN

Therefore parallel to the interministerial agreement two auxiliary not legally binding documents were signed:

- Access procedure
  - Is enforcement act for Art. 5 of the agreement. Determines in detail the access procedure for the German side to the military zones.
- Explanations concerning the execution of the agreement
  - Determines exactly the tasks of the German and Russian Project Management and of the Common Technical Committee.
  - Regulates that the German side concludes contracts directly with Russian contractors and that payment is made only after inspection of the defined scope of work

German support in dismantling nuclear submarines in Russia

EWN



Project handling organigram

EWN

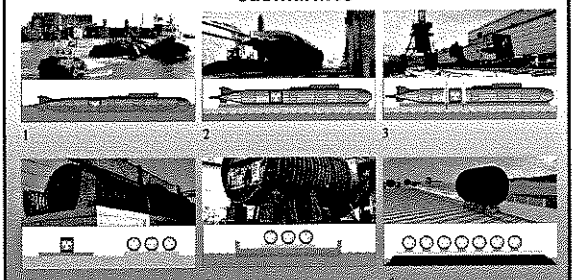
Detailed tasks

- Erection of an onshore long-term storage facility (>70 years of decay time) for 120 reactor compartments from nuclear submarines
- Establishing of an efficient material-technical basic in the Nerpa-shipyard
- Logistics of transportation and storage facility at and between both sites
- Elimination of conventional ship-wracks from the building ground in the Sayda Bay
- Disposal of nuclear and toxic waste from the dismantling of nuclear submarines
- Implementation of a Radioactive Material Management and Support Information System
- Solution of special problems of the Northern Fleet = follow-up projects

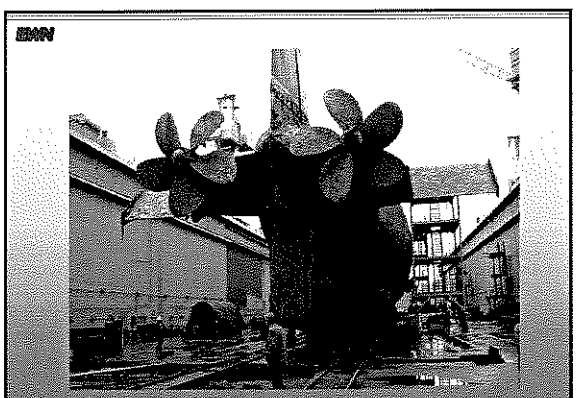
German support in dismantling nuclear submarines in Russia

EWN

Concept of the disposal of nuclear submarines



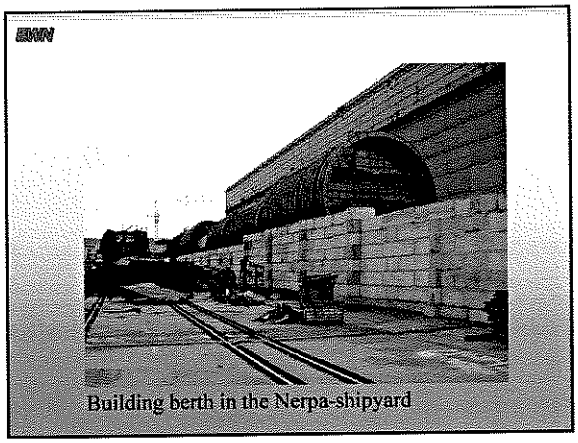
EWN



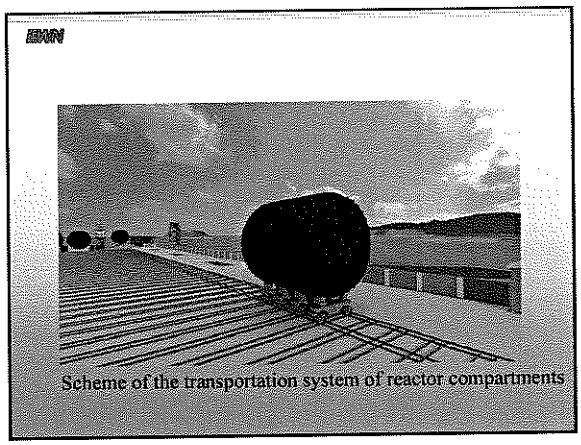
Nuclear submarine in the floating dock of the Nerpa-shipyard

EWN

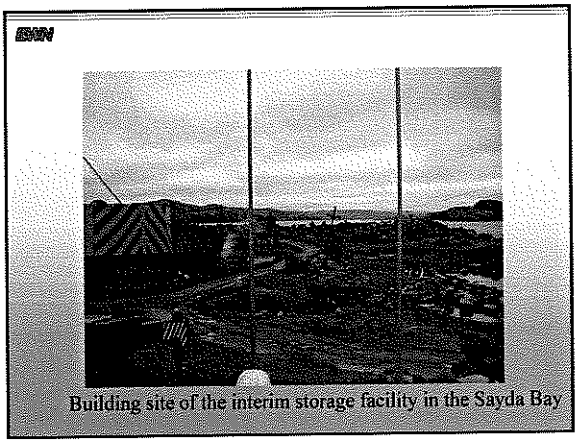
Scrap dismantling site in the Nerpa-shipyard



Building berth in the Nerpa-shipyard

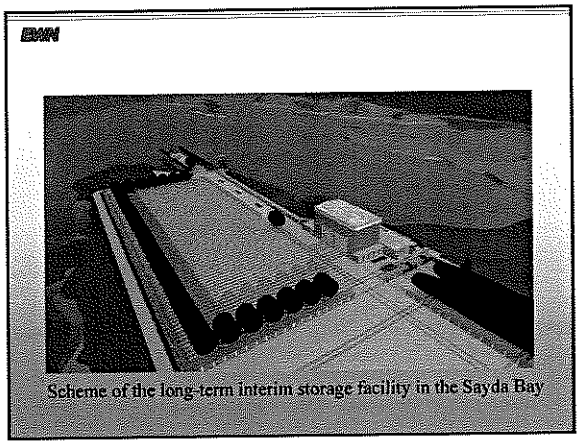


Scheme of the transportation system of reactor compartments



Building site of the interim storage facility in the Sayda Bay

„Cornerstone ceremony" interim storage facility in the Sayda Bay

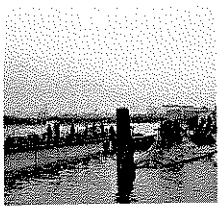


Scheme of the long-term interim storage facility in the Sayda Bay

Robert Kvile, Deputy Director General
Norwegian Ministry of Foreign Affairs

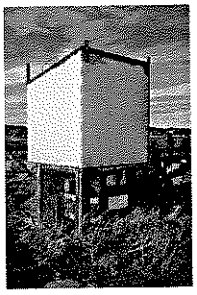
Safety and Environmental Aspects
of the Dismantlement of Nuclear Submarines

Main priorities



- Dismantlement of decomissioned nuclear submarines from the Northern Fleet

Main priorities



- Securing of highly radioactive strontium batteries from lighthouse lanterns

Main priorities

- Andreyev Bay – renovation of infrastructure and physical protetection

Main priorities

- Improvement of safety standards at the Kola Nuclear Power Plant

Main priorities

- Co-operation between Norwegian and Russian regulatory and administrative authorities

Main priorities

1. Nuclear submarines
2. Strontium batteries
3. Andreyev Bay
4. Kola nuclear power plant
5. Regulatory and administrative authorities

A key element

Risk and impact assessment

The spent nuclear fuel

Alternatives to Mayak?

Additional information

WWW.MFA.NO

International Nuclear Policy and Programmes

UK Global Partnership Programme – submarine dismantlement and related activities

Dr Alan Heyes
International Nuclear Policy and Programmes

International Nuclear Policy and Programmes

Structure of Presentation

- Brief background to UK GP Programme
- UK submarine dismantlement policy approach
- Achievements
- Projects underway
- Lessons learnt
- Challenges ahead

International Nuclear Policy and Programmes

The Bigger Picture

Focusing in this session on Russian submarines dismantlement, but benefits to UK go wider:

- Important lessons for dismantling our own submarines
- Strengthened international collaboration in the security and non proliferation area
- Enhanced Russian Navy-Royal Navy collaboration
- Enhanced project and risk management skills in the Russian Federation and sustainability to tackle more complex projects funded by Russia itself

International Nuclear Policy and Programmes

Reminder on what we are about

- Working in Partnership with Russia and other FSU countries to address nuclear legacy issues:
  - Security
  - Non proliferation
  - Safety
  - Also strong environmental benefits

Not just in the scrap metal business need to ensure we do not make the problem worse by just focusing on submarine dismantlement

International Nuclear Policy and Programmes

Strategic focus of the UK GP programme

- Securing the safe storage of Spent Nuclear Fuel (SNF) – today's focus
- Securing alternative employment opportunities for former weapons scientists and engineers
- Enhancing the security of nuclear materials
- Enhancing nuclear safety and reinforcement of the regulatory regime for nuclear power plant
- Ending Russia's production of weapon grade plutonium
- Securing the disposition of at least 34 tonnes of surplus weapon grade plutonium

International Nuclear Policy and Programmes

Achievements

- Established a substantial project portfolio covering programme objectives
- Outturn in 2004-05 was some £35m
- Excellent working relationships built up with key stakeholders in the FSU, particularly with Rosatom and Russian Navy
- Published second annual report in December 2004 (Russian version in January 2005)

International Nuclear Policy and Programmes

UK Submarine dismantlement programme -policy approach

- Not just in the metal cutting business
- **Our focus is making Spent Nuclear Fuel safe and secure**
- Top priority is to assist Russia deal with the 20,000 fuel assemblies at Andreeva Bay, and the safe containment of some 3500 assemblies at the Atomflot site, Murmansk
- Two submarines dismantled to time and cost and one more about to start at Nerpa shipyard, NW Russia
- Safe movement of submarines also a priority and working via AMEC to reduce the risks associated with moving submarines often considerable distances
- Also currently reviewing the merits of providing further SNF storage capacity at Mayak

International Nuclear Policy and Programmes

Non-proliferation status

- Most of Russia's decommissioned submarines do not present a proliferation threat
- Present a considerable security, safety and environmental threat
- SNF in some of the former Navy land bases represent particular security, safety and environmental concerns
- SNF unless effectively secured does offer potential to be terrorist target – large amounts of fissile material
- Submarine dismantlement agreed to be a priority at Kananaskis but should be seen in the context of a wider security and safety agenda as opposed to a proliferation threat

International Nuclear Policy and Programmes

Lessons Learnt

- Absolutely essential to have sound project management framework in place to manage all risks
- Importance for the donor to be an intelligent customer and not just one that provides funding
- Negotiating projects time consuming task and sharing of key information with other donors should enhance value for money and reduce project risk
- Also important for donors to be provided with adequate information to make informed decisions on projects
- Importance for close involvement of Rosatom throughout to validate costs and other details

International Nuclear Policy and Programmes

Challenges ahead

- Considerable scope for GP countries to work even closer together – sharing experiences and joint funding of projects to reduce costs and risks
- Submarines themselves not the problem – the SNF is and need to ensure the infrastructure is in place to cope with the substantial increase in movement of SNF and associated nuclear liquid and solid waste. We will not be thanked by the international community for making things worse
- Security of sites storing SNF needs to be carefully considered – as does the safe movement of SNF for long term storage or reprocessing at Mayak
- Rosatom/Russian Navy need to ensure the best practice being developing in NW Russia can be applied to the Far East
- Japan would benefit from active participation in the IAEA's Contact Expert Group to share lessons learnt

AMEC

Arctic Military Environmental Cooperation

7 June 2005

Tokyo Seminar On G8 Global Partnership
Making The World More Secure

Dieter K. Rudolph
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Arctic Military Environmental Cooperation

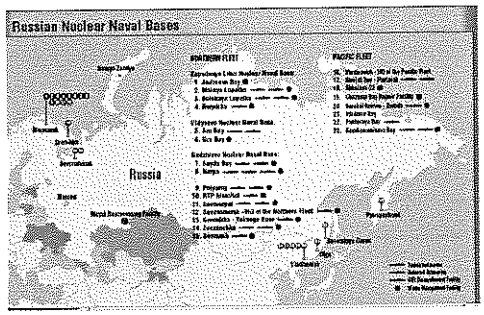
BACKGROUND

- A cooperative, military (Navy) to military (Navy) program between U.S., Norway, Russian Federation, and United Kingdom (as of 23 June 2003).
- Goal of program: mitigate impact of military operations on fragile Arctic environment. Most projects focused on radiological issues.
- Principal focus area: Northwest Russian naval bases and shipyards where extensive pollution from radiological and non-radiological waste exists.

Arctic Military Environmental Cooperation

BACKGROUND

Russian Naval Bases with Nuclear Powered Vessels

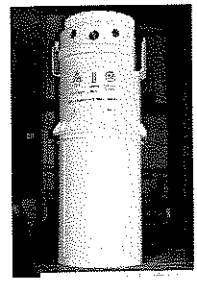


Arctic Military Environmental Cooperation

COMPLETED PROJECTS

SPENT NUCLEAR FUEL MANAGEMENT

TRANSPORT/STORAGE CASK FOR SNF



SNF TRANSSHIPMENT PAD WITH RADIATION MONITORING SYSTEM

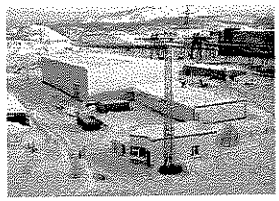
MURMANSK, RF

Arctic Military Environmental Cooperation

COMPLETED PROJECTS

RADIOACTIVE WASTE PROCESSING AND STORAGE WITH RADIATION MONITORING SYSTEM

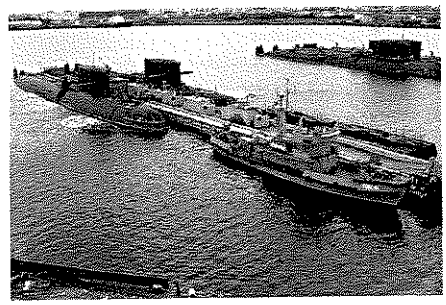
RADIOACTIVE WASTE COMPLEX



SRW STORAGE/TRANSFER CONTAINERS

Arctic Military Environmental Cooperation

ONGOING PROJECTS: BUOYANCY

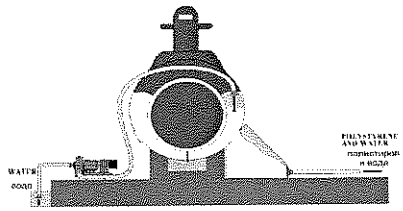


Arctic Military Environmental Cooperation

ONGOING PROJECTS: BUOYANCY

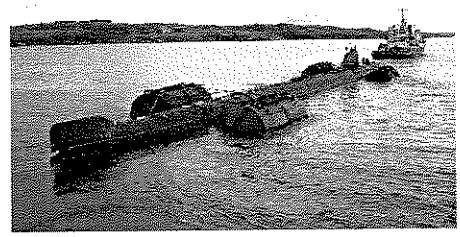
СХЕМА ИЗВЛЕЧЕНИЯ ПОЛИСТИРОЛА ИЗ ЦГБ АПЛ ВЫМЫВАНИЕМ РАБОЧЕЙ ВОДОЙ

DIAGRAM OF POLYSTYRENE WASHING-OUT FROM MAIN BALLAST TANK BY OPERATING LIQUID



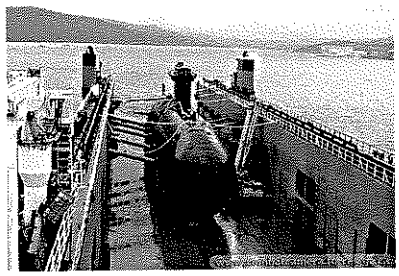
Arctic Military Environmental Cooperation

ONGOING PROJECTS: SAFE TRANSPORT



Arctic Military Environmental Cooperation

ONGOING PROJECTS: SAFE TRANSPORT



PHOTOGRAPH OF CANADIAN SUBMARINE (CHICOUTIMI) INSIDE DOCK SHIP

Arctic Military Environmental Cooperation

STUDY OF RADIOLOGICAL CONDITIONS OF THE RUSSIAN PACIFIC FLEET AND ITS BASES IN THE FAR EAST

- Compared to Russia's North West, the Far East is not receiving enough attention from the international community since the radiological problems are at least equal to if not greater than in the Russian Northwest
- Objectives are to assess the radio-ecological state, systemize information on decommissioned nuclear vessels and the related dismantling infrastructure in Russia's Far East
- Study is 2/3 complete
  - 1st Milestone Report: analysis & systemization of SNF and RW management, Reactor Compartment storage and Nuclear Service Vessels, completed January 2005
  - 2nd Milestone Report: analysis of radio-ecological monitoring at dismantlement sites, identification of hot spots and remediation problems, completed May 2005
  - 3rd Milestone Report: identification of priority tasks, to be completed November 2005
- Can be used as input data for developing a Master Plan for the Far East

Arctic Military Environmental Cooperation

STRATEGIC MASTER PLAN FOR RUSSIA'S FAR EAST (SMP-FE)

- A strategic master plan for Russia's NW is under development by ROSATOM and the Northern Dimension Environmental Program (NDEP) – NUCLEAR WINDOW
  - The plan addresses decommissioning of nuclear submarines, nuclear-powered surface ships and nuclear maintenance vessels taken out of operation and environmental rehabilitation of related radiation hazardous facilities in NW Russia
  - Initial phase is completed and identifies high priority and priority measures that should be solved immediately
- A plan to address such problems in Russia's Far East does not exist
- There are problems unique to the Far East
  - Two shipwrecked nuclear submarines in Paviovsky Bay provide special challenges
  - Transportation route from storage site to dismantlement site is much greater than in NW Russia and is across the open sea and more susceptible to extreme weather conditions, nearer to major population centers and more accessible to terrorist's attacks
  - The infra structure decommissioning and dismantling of nuclear ships is less complete than in the Russian Northwest
- A similar collaborative effort to the SMP-NW is needed for Russia's Far East

Arctic Military Environmental Cooperation

Russian Academy of Sciences

Nuclear Safety Institute

Radioecological Problems in Complex Decommissioning of the Russian Nuclear Fleet and Environmental Remediation of Contaminated Facilities in the Far East Russia

Academician A.A.Sarkisov

1

Actual Situation in Complex Decommissioning of Nuclear Submarines in the Far East Russia

- Lower paces of Nuclear Submarine (NS) decommissioning as compared to those in the Northwest Russia (by a factor of 1.5).
- Availability of terrestrial and aquatic areas with disturbed radioecological situation in Chazhma Bay, Pavlovskiy Bay and Coastal Maintenance Bay (CMB) in Sysoeva Bay.
- Two NS with damaged Power Reactor Installations (PRI) in Primorskiy kray.
- Decentralization of waterborne storage centers for decommissioned NS and supporting infrastructure facilities.

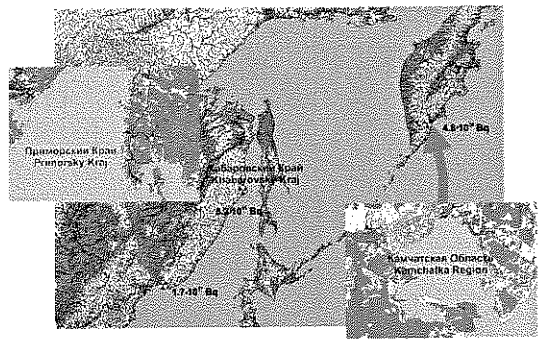
2

Current Status of NS Complex Decommissioning-related Works in the Far East Russia

- 77 NSs withdrawn from service in the Pacific Fleet. 40 NSs dismantled (made up: 38 3-compartment Reactor Units (RU), one 4-compartment RU and one 9-compartment RU). 37 NSs are pending complex decommissioning (30 non-defueled NSs, 7 defueled NSs).
- None of the taken-out-of-service NSs has been dismantled down the ultimate phase – one-compartment RU.
- Low NS dismantlement paces in Kamchatka force to take a decision on transfer several NS and RU and some amount of Spent Nuclear Fuel (SNF) to Primorskiy kray unless additional funding is found for implementation of alternative solutions.
- Lack of a Long-term Storage Facility (LSF) for one-compartment RUs.
- Limited SNF removal paces from Far East Plant (FEP) "Zvezda" to "Mayak" due to unsatisfactory condition of the trunk railway for high-capacity railcars between Bolshoy Kamen and Smolianinovo railway stations.
- Lack of a unified automated radioecological monitoring system and a crisis situation preventing system at individual facilities and in the Far East region as a whole.

3

Distribution of Radiation Potential of Complex Decommissioning Facilities in the Far East Russia



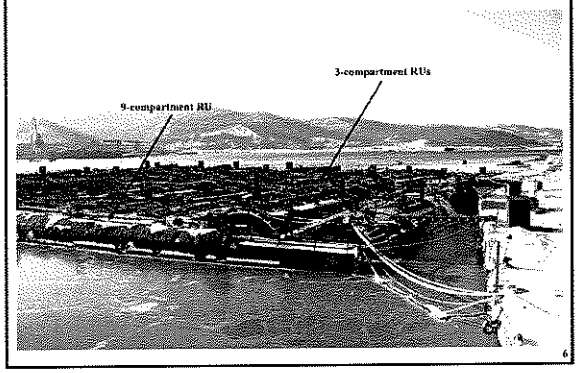
4

Generalized Comparative Data on the Activity Accumulated during Complex Decommissioning Operations in the Northwest Russia and the Far East Russia

Region	SNF, Bq	LRW, Bq	SRW, Bq
Murmansk region	$3\cdot10^{17}$	$8\cdot10^{12}$	$2\cdot10^{16}$
Arkhangelsk region	$4\cdot10^{16}$	$8\cdot10^{11}$	$9\cdot10^{14}$
Σ Northwest Russia	$3.4\cdot10^{17}$	$8.8\cdot10^{12}$	$2.1\cdot10^{16}$
Primorskiy kray	$2\cdot10^{17}$	$2\cdot10^{12}$	$7\cdot10^{15}$
Kamchatka	$5\cdot10^{16}$	$2\cdot10^{12}$	$4\cdot10^{15}$
Σ Far East Russia	$2.5\cdot10^{17}$	$4.0\cdot10^{12}$	$1.1\cdot10^{16}$
Proportion relative to the Northwest Russia	74 %	45 %	52 %

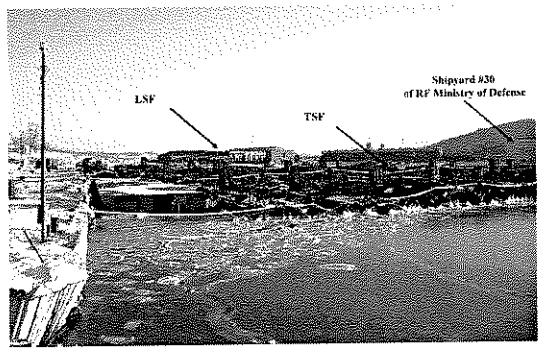
5

Arrangement of Reactor Compartment Units at the Temporary Storage Center (TSF) in Razboinik Bay

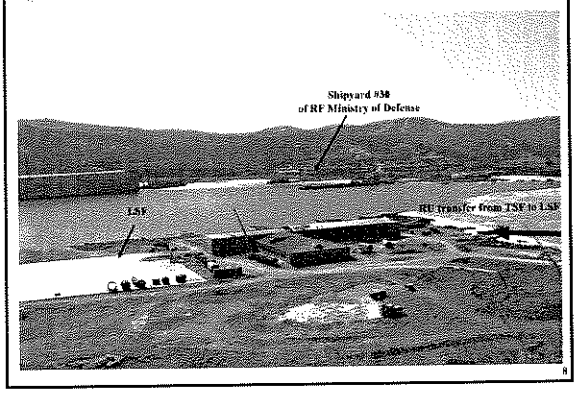


6

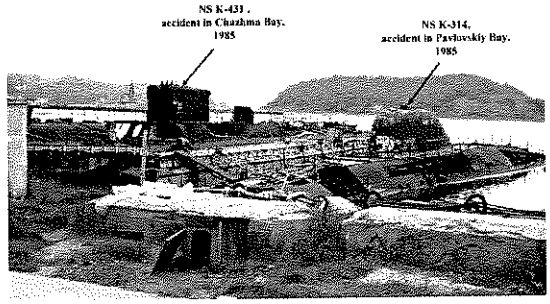
Location of TSF and LSF for Reactor Compartment Units in Razboinik Bay (Primorskiy kray)



Construction of LSF for RU in Razboinik Bay



Damaged NSs K-431 and K-314 in Pavlovskiy Bay



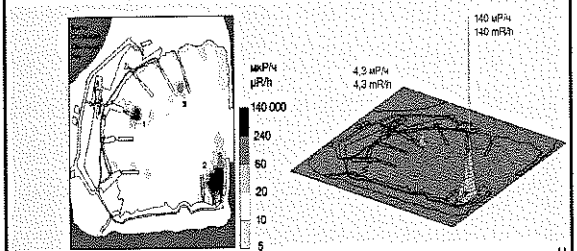
Radiation Situation in Reactor Compartments of NSs with Damaged PRIs (both accidents occurred in 1985)

Parameter	NS K-431	NS K-314
Accident description	SCbR, heat explosion, radiation release to the environment	Core melting, radiation release to reactor compartment
Beta-contamination density, decay/min·cm²	up to 10000	up to 1000
Alpha-contamination density, decay/min·cm²	up to 60	up to 10
Exposure dose rate, mSv/h	10 - 200	5 - 60
Mean admissible time of staying in reactor compartment, h/year	0.1 - 2	0.3 - 4

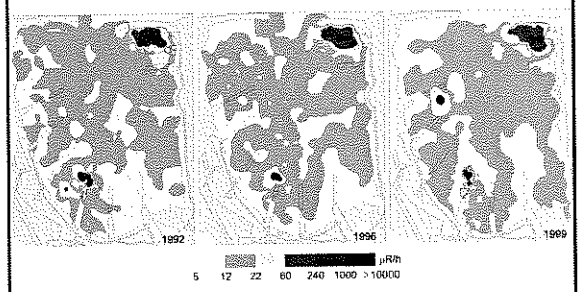
3D and 2D Representation of Gamma Fields in Bottom Sediments, Pavlovskiy Bay

(no similar environment contamination source in the Northwest Russia)

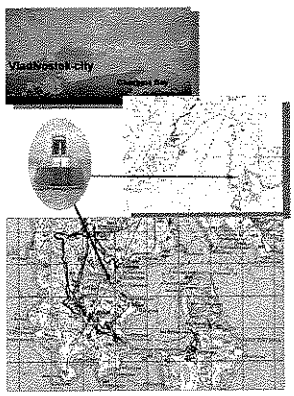
1. – Consequences of NS PRI accident
2. – Waterborne storage of 2 NSs with damaged cores
3. – Berthing of special vessels



Gamma Fields of Bottom Sediments in Pavlovskiy Bay, Different Years

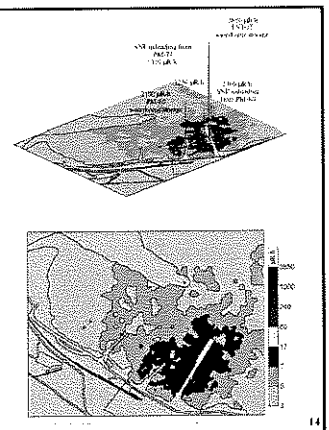


Location of NS K-431 accident, August 10, 1985, Primorskiy kray, Vladivostok-city, Dunay settlement, Chazhma Bay
(the only accident throughout the Russian Navy's history with active release of radioactive substances to the environment and radioactive trace generation)



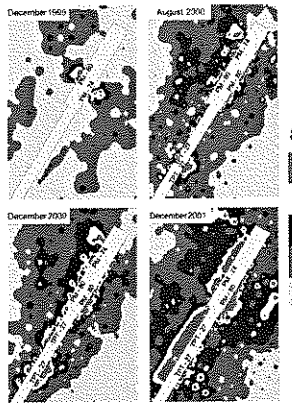
13

Gamma Fields of Bottom Sediments in Koniushkovo Bay after SNF Unloading and Radioactive Waste (RW) Management



14

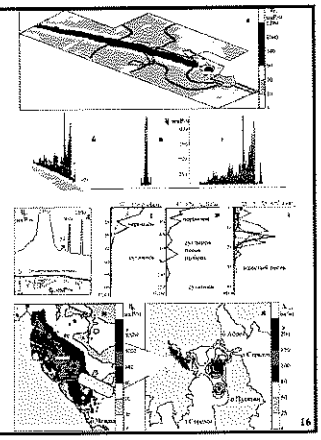
Unloading of SNF from damaged FSVs and protracted storage of damaged tank ships with LRW result in radioactive contamination of bottom sediments



15

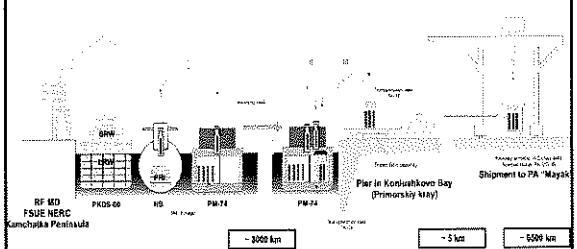
Initial parameters of trace:
- length up to 10 km;
- width up to 0.8 km.

Generalized Characteristics of ^{60}Cobalt 3D Distribution within On-shore and Off-shore Fragments of the Radioactive Trace (1990 – 2000)



16

Transport and Process Flowsheet when Transferring SNF from Kamchatka to Primorskiy Kray

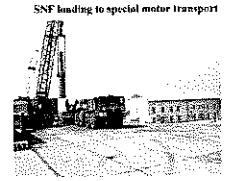


17

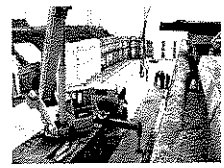
Preparing SNF for Transfer to "Mayak" at CMB in Sysoeva Bay

SNF unloading from storage facility

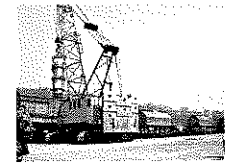
SNF loading to special motor transport



SNF reloading into transportation casks



SNF loading to special train



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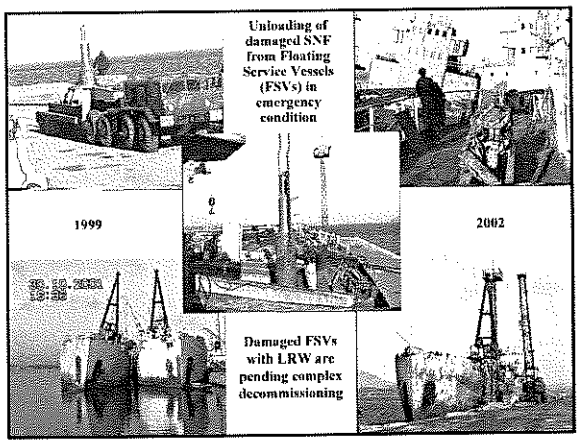
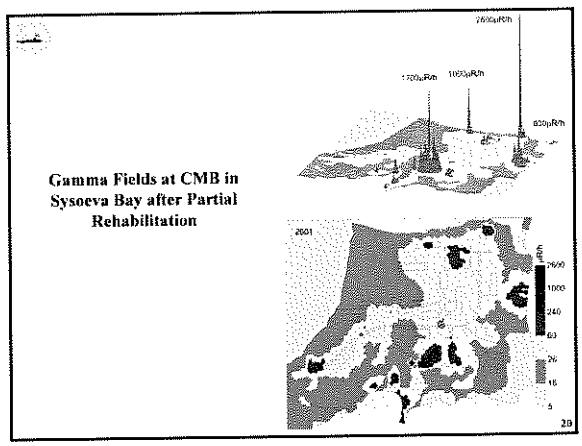


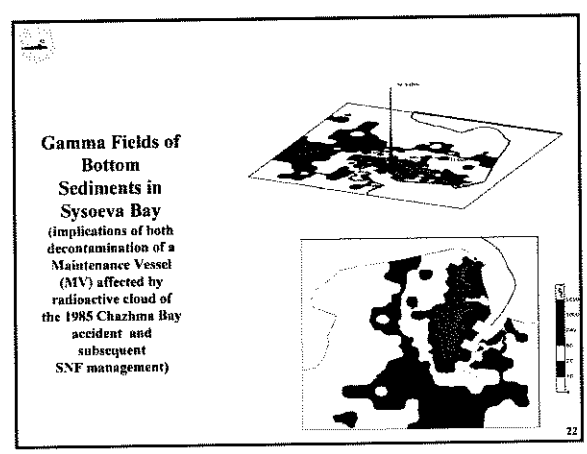


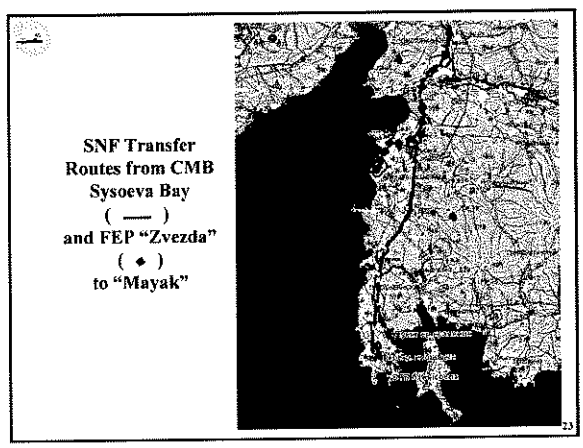
Radiation Situation at CMB in Sysoeva Bay
(residual contamination after rehabilitation)

Contaminated objects	P_γ, μSv/h	N_β, decay/min·cm^2	^{137}Cs concentrations in soils, Bq/kg
Storage facility for Spent Fuel Assemblies (SFAs)	5 ÷ 35	> 3·10^4	-
Ravine (beyond CMB site, close to LRW storage facilities)	0.2 ÷ 6.4	< 20 ÷ 190	4·10^5
Slope (beyond CMB site, close to SRW storage facilities)	0.2 ÷ 5.8	< 20 ÷ 140	2·10^5

Background values: P_γ = 0.08 – 0.12 μSv/h;
N_β - < 20 decay/min·cm^2;
Soil: ^{137}Cs, ^{90}Sr - < 10 Bq/kg.

21





Potential Radiation Accidents at NSs and Maintenance Vessels Subject to Complex Decommissioning and the Related Coastal Infrastructure Facilities

Accident type	Probability	Cause of accident	Potential implications
High-power explosion at MV with RW or SNF	~ 1·10^{-7}	Terrorist attack, aircraft fall	Vessel sinking; radiation release to atmosphere; contamination of terrestrial and aquatic systems
Self-sustained Chain Reaction (SCHR) during NS defueling or at SNF storage facility	~ 1·10^{-7}	Violation of process flowsheet during SNF unloading; errors of personnel; terrorist attack	Large-scale contamination of terrestrial and aquatic systems; transboundary transfer
Coast fire during nuclear vessel dismantlement (defueling)	~ 4·10^{-6}	Violation of process flowsheet and safety rules; errors of personnel; aircraft fall	Radiation release to atmosphere
Sinking of Floating Service Vessel (FSV) with SNF	~ 4·10^{-6}	Navigation accident; extreme weather conditions; errors of personnel; terrorist attack	LRW release to seawater; nuclear fuel corrosion
Destruction of LRW/SRW storage facility	~ 1·10^{-5}	Terrorist attack; aircraft fall; extreme weather conditions	Contamination of terrestrial and aquatic systems
Sinking of non-defueled NS at basing center or docking boulage	~ 4·10^{-4}	Navigation accident; extreme weather conditions; errors of personnel; terrorist attack	LRW release to seawater; nuclear fuel corrosion
RW sinking at shipyard water area or during haulage	~ 1·10^{-4}	Violation of process flowsheet and safety rules; errors of personnel; unfavorable weather conditions; navigation accident	Release of activation radionuclides to seawater is possible
LRW release to seawater when transferring to/from tank ship	~ 3·10^{-4}	Violation of process flowsheet and safety rules; errors of personnel; unfavorable weather conditions	Radionuclide release to seawater

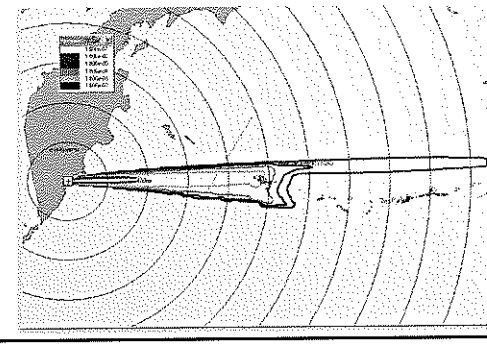
24

Expected Implications of SChR at NS, while Defueling, with Consideration for the Chazhma Bay Accident Consequences

Radiation situation around NS 24 hours after accident, distance up to 100 m	Beta-contamination density, decay/cm²·min	^{137}Cs contamination density, Ci/km²	Gamma dose rate, mSv/h
Chazhma Bay accident (with non-irradiated fuel)	~ $1 \cdot 10^6$	~ 2	~ 10
Hypothetical accident during NS defueling	~ $1 \cdot 10^6$	~ 140	~ 800

25

Distribution of Annual Effective Dose over the Radioactive Trace in a Case of Hypothetical SChR at Shipyard in Kamchatka (if Atmospheric Precipitations Were Available)



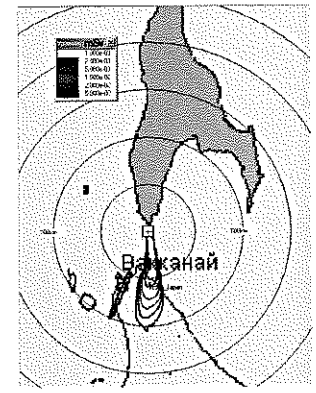
26

Quantitative Estimates of Radiation Implications of a Hypothetical SChR Accident at Shipyard (Kamchatka)

Parameters		Estimate results		
		Kamchatka Petropavlovsk-Kamchatskiy (Russia)	Aleutian Islands (USA)	Hokkaido Island (Japan)
Distance from accident epicenter, km		20	1000	1400
Radioactive cloud transfer duration, h		0.8	40	50
Inhalation duration, h		0.2	10	15
Effective inhalation dose, μSv		200	0.7	0.3
Maximal contamination density, Bq/m²	"dry" depositions	200000	400	300
	"wet" depositions	900000	2000	1600
Maximal annual equivalent dose, μSv	"dry" depositions	250	0.8	0.4
	"wet" depositions	400	1	< 1

27

Distribution of Annual Effective Dose over Radioactive Trace after Hypothetical Accident Caused by Explosion at MV PM-74 in La Perouse (Soya) Strait



28

Quantitative Estimates of Radiation Implications of a Hypothetical Accident Caused by Explosion of MV (Type *PM-74*) in La Perouse (Soya) Strait and at Shipyard (Kamchatka)

Parameters		Estimate results		
		Hokkaido Island (Japan)	Kamchatka Petropavlovsk-Kamchatskiy (Russia)	Aleutian Islands (USA)
Distance from accident epicenter, km		50	20	1000
Radioactive cloud transfer duration, h		3	1,2	25
Inhalation duration, h		0,5	0,2	35
Effective inhalation dose, μSv		55	1400	2
Maximal contamination density, Bq/m²	"dry" depositions	30000	1000000	900
	"wet" depositions	180000	2000000	6500
Maximal annual equivalent dose, μSv	"dry" depositions	60	1800	< 2
	"wet" depositions	100	2800	2,5

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Generalized Scheme of Currents in the Northern Pacific

30

Structure of Potential Indirect Damage during Radiation Accidents

1. Economic damage due to excess measures on elimination of accident consequences
2. Psychological stress
3. Damage due to changes in the society attitude to atomic energy
4. Damage due to changes in export potential of affected country
5. Damage due to economic recession (fishery)
6. Recession in bi-lateral and multi-lateral international cooperation
7. Damage due to activities of extremist groups (including the "Green movement" groups)
8. Damage due to need of active work with general population, political groups and public authorities

31

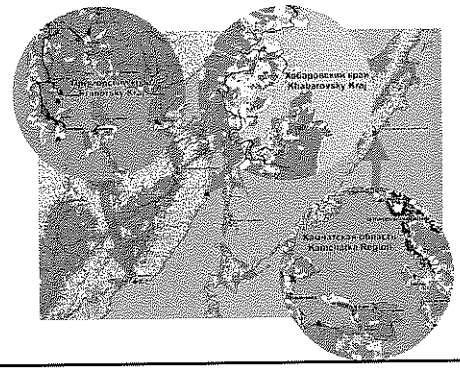
Nuclear and Radiological Terrorism – New Threats from SNF and RW Accumulated in Regions

Possible Sources of Potential Terrorist Threats:

- SNF use for nuclear charge making;
- Use of SNF and RW storage facilities at service vessels and coastal maintenance bases for terrorist attacks (fires and explosions);
- Use of medium-activity LRW and SNF elements for "dirty" bomb making.

32

Regions Requiring Development of Automated Radioecological Monitoring Systems in the Far East Russia



33

Information-Analytical Center for Environmental Safety, Monitoring and Crisis Situations in the Far East Russia

- running automated monitoring of radiation and radioecological situation at all radiation-hazardous facilities and in their radiation control areas under normal operating conditions and in a case of emergency;
- support of decision-making on protection of workers, population and environment;
- rendering information-analytical assistance when eliminating the implications of nuclear and radiation accidents;
- providing local, regional and federal authorities with necessary running information;
- providing Russian and foreign public organizations and mass media with data for open information exchange.

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Nuclear Safety Institute (IBRAE)
Russian Academy of Sciences (RAS)

STRATEGIC MASTER PLAN

Strategic Approaches in
Solving Decommissioning Problems of Retired Russian Nuclear Fleet in the North-West Region
(SMP – NW)
and
Necessity for the Development of SMP for the Far East Region
(SMP – FE)

Corresponding Member of RAS L.A. Bolshov
Director

June 7, 2005

Strategic Master Plan should:

- be the basis for strategic decision-making by the Government of the Russian Federation and determining the order of works related to complex decommissioning of NS and management of SNF and RW in the Northwest Russia;
- facilitate evaluations by the donor countries of technical and economic efficiency and safety in the decommissioning project implementation;
- facilitate making of balanced and justified decisions with due accounting of relevant interests of the Russian Federation and the donor countries;

Specific Features of SMP

as compared to other conceptual documents

1. SMP is not an internal document of Rosatom.
2. Development of SMP was financed by the Northern Dimension Ecological Partnership (NDEP) fund. International expert group has played an important role during the development of SMP.
3. Justification of priority objects, tasks and activities within the framework of complex decommissioning of the Russian nuclear fleet is an essentially new element of the SMP.

SMP Purpose

SMP should be a comprehensive and equilibrium Program integrating a variety of interconsistent sub-programs and projects, determining for each of them:

1. Ultimate goals
2. Scope and contents
3. Place in the system of projects
4. Duration
5. Potential executors
6. Range of cost
7. Safety parameters
8. Other characteristics

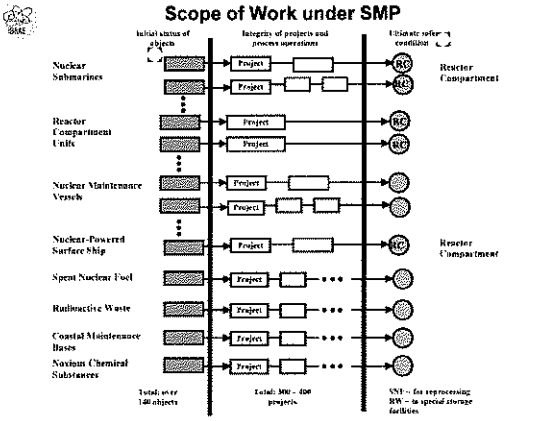
SMP-NW Development Due Dates

Start – February 2004

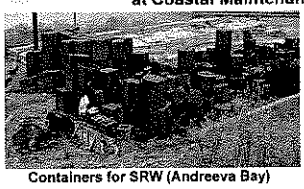
Phase I completion - October 2004

Phase II duration – 20 months

Scope of Work under SMP



Actual Condition of SRW Storage Pads at Coastal Maintenance Bases (CMB)

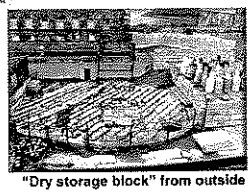


Containers for SRW (Andreeva Bay)

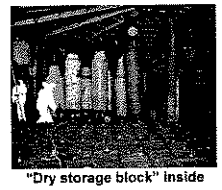
Open-air SRW storage pad (Andreeva Bay)

Open-air SRW storage pad (Gremikha)

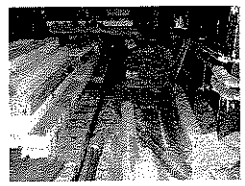
Actual Condition of SNF Storage Facility in Andreeva Bay



"Dry storage block" from outside



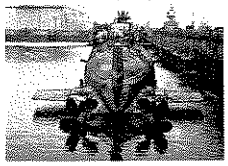
"Dry storage block" inside



Former "Wet storage block"

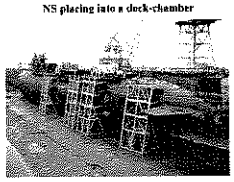
Main NS Dismantlement Phases

NS towing to shipyard

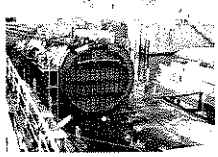


Missile shaft cutting out

NS placing into a dock-chamber



3-compartment unit making up



COVER PAGE OF SMP-1

IBRAE

RRC KI

STRATEGIC APPROACHES IN SOLVING DECOMMISSIONING PROBLEMS OF RETIRED RUSSIAN NUCLEAR FLEET IN THE NORTH-WEST REGION

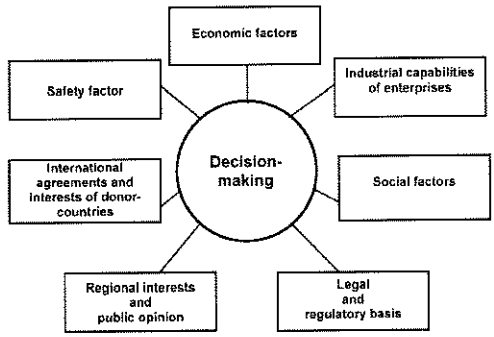
Executive Summary of
Strategic Master Plan, Phase 1

Brought in effect	Confirmed	Approved
By the order of the Head of the Federal Agency for Atomic Energy No 257, December 1, 2004	By the NDEP Nuclear Executive Committee, November 5, 2004	By the Assembly of the Donor Countries, December 6, 2004

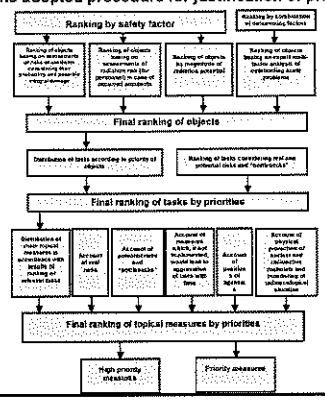
Main Results and Importance of Phase 1 (SMP-1)

- Phase 1 (SMP-1) was a preparative stage for the main - second – phase (SMP-2)
- SMP-1 addresses:
  1. Technical and radiological condition of all objects of complex decommissioning and related supporting infrastructure in the Northwest Russia
  2. Process and management cycles; sources of hazards and risks
  3. "Bottlenecks" and unresolved problems
  4. Methodology for priority assessment
  5. Lists of top-priority tasks and measures to be used when generating first-priority projects during SMP-2 implementation

Main Factors Influencing Decision-making while Identifying Priorities in NS Complex Decommissioning



Logic and sequence of stages of the adopted procedure for justification of priorities



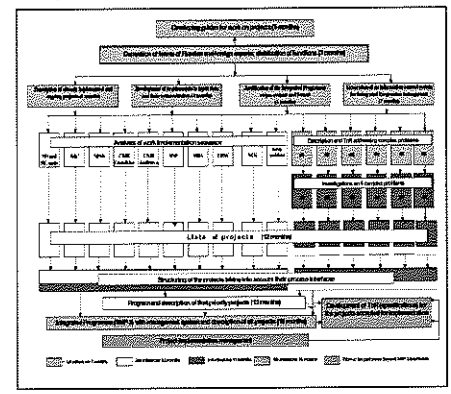
Top-priority measures (21)

- Development of FS to justify optimum and safe options of SNF management in CMB in Andreeva Bay.
- Integrated Engineering and Radiation Survey (IERS) of buildings, structures, territory and water area of CMB in Andreeva Bay. Inventory taking of SNF and SRW.
- Restoration of infrastructure for SNF management in CMB storage facilities in Andreeva Bay (irrespectively of the ultimate option of SNF management in the North-West Russia).
- Development of FS, required design and engineering documentation. Creation of the regional center for reprocessing, conditioning and storage of SRW in the North-West Russia.
- Development and implementation of projects to ensure physical protection at CMB in Andreeva Bay.
- Implementation of measures to support radiation safety of the personnel in the territory of CMB in Andreeva Bay.
- IERS of buildings, structures, territory and water area of CMB in Gremikha. Inventory taking of SNF and SRW.
- Development of FS to select optimum and safe options of SNF management in CMB storage facilities in Gremikha.
- Development of FS to select optimum and safe options of SRC management in CMB storage facilities in Gremikha.
- Development of FS and implementation of project to eliminate the open-air pad for SNF and RW storage at CMB in Gremikha.
- Implementation of measures to support radiation safety of the personnel in the CMB territory in Gremikha.
- Development and implementation of projects to ensure physical protection of CMB in Gremikha.
- Restoration of infrastructure of the facility in Gremikha for unloading SRC from reactors of *Alpha* class NS.
- Development and implementation of project for reconstruction of SRC storage facility at CMB in Gremikha.
- Restoration of infrastructure for management of SNF located in storage facilities at CMB in Gremikha (irrespectively of the ultimate option of SNF management in the North-West Russia).
- Development of FS and design, engineering and process documentation for decommissioning of FMB *Lepse*.
- Development of the project and implementation of work to reconstruct the railway bridge over Nikolskolje Ustie in Severodvinsk.
- Drafting of the working documentation for forming RC and their long-term storage.
- Completion of works to establish a land-based RC long-term storage facility.
- Establishment of site-wide, regional monitoring and emergency systems in Murmansk Region.
- Establishment of site-wide, regional monitoring and emergency systems in Arkhangelsk Region.

Priority measures (24)

- Development of FS for RW management in Andreeva Bay. Creation of necessary technical capabilities.
- Removal of SRW from open-air pads in Andreeva Bay.
- Development of FS for rehabilitation of buildings, structures, territories and water areas in Andreeva Bay.
- Development of FS for RW management in Gremikha. Creation of necessary technical capabilities.
- Development of FS for rehabilitation of buildings, structures, territories and water areas in Gremikha.
- Development of a special technology and manufacturing of tooling for safe removal of SRC from reactors of *Alpha* class NS No 901 where there is an unfavorable radiation situation in the reactor compartment.
- Design and fabrication of specialized pontoons or lease of transportation vessel.
- Continuous maintenance and recovery repairs at FSV and reloading equipment.
- Creation of special mobile reprocessing installations for LRW of complex chemical composition;
- Manufacturing and supply of installations for filling NS DBT with polystyrene as well as modular diesel compressor installations.
- Scheduled decommissioning of NS.
- Radiation survey of MV. Development of EDCD for sealing, preparing and waterborne storage. MV sealing.
- Inventory taking and removal of RW from MV.
- Development of equipment and infrastructure at PA Mayak for handling TUK-108/1 containers.
- Repair of existing and building of new piers in Saida Bay.
- Development of projects for forming units for storage of SFA at FMB and their long-term storage in LSF.
- Development of EDCD for decommissioning of NPSS and forming a reactor hall unit (RHU). Execution of the work. Transfer of RHU to LSF.
- Development of the concept and technology for management reactor unit № 900 of *Alpha* class NS.
- Development of FS and implementation of projects for management of toxic waste and for creation of their storage pads.
- Development of the concept and technologies, selection of location and drafting of design documentation on facilities for ultimate elimination and disposal of toxic waste.
- Development of the concept, selection of location and drafting of design documentation for creation of the regional RW repository.
- Creation of the buffer container storage facility at PA Mayak.
- Conditioning of non-reprocessible SNF at MV of MSC.
- Creation of the temporary container storage facility for non-reprocessible SNF at Atomflot

Flow Diagram for Strategic Master Plan Phase 2 (SMP-2) Development



Phases and Contents of Works on SMP-FE Development

Phase I **10 – 12 months** **~ $ 500 000**	**•analysis of actual condition of all concerned objects and the process capacities of existing infrastructure in the Far East Russia;** **• analysis of legal and regulatory framework;** **• analysis of hazard sources;** **• justification of unresolved problems and "bottlenecks";** **• development of priority-identification methodology as applied to the Far East Russia;** **• determining top-priority tasks and projects.**
Phase II **18 months** **$ 5 000 000**	**- studying complex problem tasks;** **- drawing up lists and project descriptions;** **- developing a Program of topical activities;** **- generating an Integrated Program and a managerial system for its implementation.**

Initial Steps on SMP-FE Development

By Rosatom's request development of "Strategic approaches to SMP-FE Generation" has begun (initial stage).

A contract with Brookhaven National Laboratory, USA, for the initial stage of SMP-FE Phase I have been prepared for signatures.

Result: by now only ≤ 3% of necessary funding sources have been determined

To develop SMP-FE, joining of efforts and resources is indispensable

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