

**PERMITTING AND LICENSING RUSSIAN LOW LEVEL RADIOACTIVE WASTE VOLUME
REDUCTION FACILITIES AT ZVEZDA AND ZVEZDOCHKA SHIPYARDS**

By:

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ABSTRACT

U.S. and Russian strategic dismantlement of weapons of mass destruction included decommissioning and dismantling Russian Delta-class nuclear submarines. Limited nuclear waste processing and storage facilities in the Northern Fleet and Far East, however, could not support the dismantlement effort. The U.S. Defense Department's Low Level Radioactive Waste Volume Reduction projects were designed to process solid and liquid radioactive wastes generated by submarine dismantlement at two Russian shipyards in compliance with international environmental and safety standards.

Permitting and licensing these facilities was a complex challenge, involving coordination of multiple approval paths within an evolving regulatory environment. Initially, a declaration of intentions was developed to obtain initial approval of the projects with the local authorities. The development of "Working Designs" followed which were the principle vehicles for eliciting and securing regulatory approvals. Approval of the Working Designs included independent review of the design for nuclear radiation safety by expert organizations licensed to review nuclear projects. Approval also included review of the projects by a panel of experts in evaluating the environmental impacts of the proposed activities. Approval of the designs further required coordination with a broad array of local and federal entities with responsibilities for such projects. The multiple reviews and coordinations required the project engineers in the design agency to address many comments pertaining to the Working Design, but few required major modifications in the facility design. Minimizing changes with the attendant cost and schedule impacts required constant interaction and negotiation between regulators, expeditors, reviewers, designers, the shipyards, and project managers throughout the course of the project.

Initial phases of construction, including demolition and refurbishment activities, were carried out in parallel with the review and approval of the Working Design and development of the Final Design to maximize schedule efficiency. Facility approval, consisting of the operating permit, sanitary passport, and operating license, were to take place once operators were trained, and after installation and system "hot" tests were successfully completed. The methodologies and generalized procedures used in this project are timely, and could be used successfully on other planned, or future, joint U.S.-Russian nuclear waste design-build projects.

BACKGROUND

More than 10,440 m³ of liquid low level radioactive waste (LLRW), and more than 24,000 m³ of solid LLRW, may be in the inventories at Russian naval bases in the Primorskiy Region of the Russian Far East and the Russian Northern Fleet (Bradley 1997) (1). The generation rate of LLRW for the next 10-15 years may exceed 4,500 m³ per year and 6,000 m³ per year for liquid and solid radioactive low level waste, respectively (Bradley 1997) (1). New radioactive waste management facilities would reduce the burden related to storage of nuclear waste in Russia.

LLRW volume reduction facilities were planned at the Zvezda (Star) and Zvezdochka (Little Star) facilities in the Russian Far East and Northern Fleet areas. The submarine service plant, Zvezda is located at the city of Bolshoi Kamen, 35 km east of Vladivostok. Zvezda was founded in 1954 as a dock for warships and submarines, and has historically been responsible for refueling, repairing, and decommissioning of nuclear submarines. Zvezdochka is one of two shipyards located at Severodvinsk, 35 km west of Arkhangelsk. Zvezdochka is one of the largest naval yards in Russia, has been operational since 1936, and nuclear submarines were both built and serviced there. The Severodvinsk shipyards are the main centers for nuclear submarine decommissioning.

The LLRW Project, administered by the U.S. Defense Threat Reduction Agency (DTRA), is part of U.S.-Russia agreements on the strategic dismantlement of weapons of mass destruction. The new LLRW facilities were

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designed to process solid waste, decontamination and mixed wastewater, primary loop wastewater, bioprotection wastewater, and laundry wastewater from dismantled Delta Class submarines. The methodologies and generalized procedures used in licensing and permitting of the LLRW project, have the potential to be used successfully on other planned, or future, joint U.S.-Russian nuclear waste design-build projects.

RUSSIAN REGULATORY BODIES ASSOCIATED WITH LLRW PROJECT

Prior understanding of the roles of RF regulatory agencies, as well as establishing and working with key contacts within each organization, facilitated licensing and permitting. RF nuclear weapons disarmament organizations are categorized as control, standards development, and supervisory and inspection bodies (Table I). The Ministry of Atomic Energy (MinAtom) typically maintains control over nuclear projects, however, the Ministry of the Economy (MinEcon) maintained control for LLRW Project (because MinEcon owns the land the shipyards occupy).

Table I. RF Governmental Organizations Relevant to LLRW Project

RF Organization	Control in Relation to LLRW	Standards Development In Relation to LLRW	Supervision & Inspection In Relation to LLRW
Ministry of Economy	Strategic Arms Limitation Projects	Not Applicable	Not Applicable
Federal Nuclear and Radiation Safety Authority of Russia	Not Applicable	Nuclear Safety	Nuclear Safety
RF Supervisory Authority for Mining and Industrial Safety	Not Applicable	Non-Nuclear Technical Safety	Non-Nuclear Technical Safety
Committee for Standardization and Metrology	Not Applicable	General Standards Development/Approval	Limited Approved Standards Application
Ministry of Atomic Energy	Nuclear Equipment Technologies	Nuclear equipment technologies with Gostandardt and GosAtomNadzor Approvals	Not Applicable
RF Ministry of Internal Affairs	Not Applicable	Nuclear Physical Security	Nuclear Physical Security
State Committee of the RF for Environmental Protection	Not Applicable	Indirect standards input – radiological & chemical release limits	Evaluation of radiological & chemical release monitoring data
Ministry of Health, RF Sanitary and Epidemiology Supervisory Authority	Not Applicable	Immediate Human Environment – Occupational Health, Pollution Protection of Environment, Sanitation, Public Health	Immediate Human Environment – Occupational Health, Pollution Protection of Environment, Sanitation, Public Health
RF Fire Protection Inspection Agency	Not Applicable	Fire Prevention and Safety	Fire Safety
RF Ministry of Labor and Social Development	Not Applicable	Non-Radiological and Non-Technological Occupational Safety and Health	Non-radiological and non-technological occupational safety and health inspections
Local Authorities	Limited authority over industrial/human activities in territory.	Not Applicable	Not Applicable

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The Federal Nuclear and Radiation Safety Authority of Russia (GosAtomNadzor or GAN), and the State Committee of the RF for Environmental Protection (GosComEcology) acted as primary standards development bodies which drafted technical and performance specifications for LLRW Project. Supervision and inspection was done by local and regional GAN, the RF Supervisory Authority for Mining and Industrial Safety (GosGorTechNadzor), RF Committee for Standardization and Metrology (Gostandart), and the RF Fire Protection Inspection Agency (GosPozhNadzor). GosComEcology had limited authority to evaluate data on chemical and radiological releases. Routine local construction inspections were also required.

REGULATORY COMPLIANCE AND LICENSING FOR LLRW PROJECT

The technical approach for the LLRW project called for segregation, size reduction, decontamination, and low-force compaction to achieve volume reduction goals for solid wastes. Liquid waste would undergo filtration, selective sorption, reverse osmosis, and direct precipitation. Sorbents were already employed in Russia at Murmansk, some technologies were ISO 9000 compliant, and/or equipment was considered to be “low technology.” Therefore, negotiating the complexities of licensing and permitting in the RF system were expected to be favorable.

An integrated strategy toward construction and regulatory compliance was developed early in the project. The team included experts in U.S. as well as RF regulations, and benefited from having the Russian State Unitary Enterprise All-Russian Design and Research Institute for Complex Power Technology, VNIPIET, actually design the liquid systems. The LLRW design was to be fully compliant with Russian laws and standards, however, observance of more stringent U.S. radiological release limits was required. Key compliance milestones were initially thought to include Environmental Expertise Review, Hazardous Activities Licensing, and Environmental Certifications. DTRA was expected to handle all aspects of shipping and customs.

The RF nuclear permitting and licensing process, as it applies to the LLRW Project, is shown in Figure 1 (see Figures at the end of the document). The relevant approval authorities for the project are listed in Figure 2. The permitting process involved early and frequent interaction between the project team and regulatory experts in all aspects of design development, system requirements definition, technical and working design development, construction, and qualification testing. This interaction ensured timely identification and resolution of issues.

Preliminary Declaration of Intent and Approvals

Zvezda and Zvezdochka shipyards each submitted preliminary Declarations of Intent to local governments for approval of the construction. These generalized project descriptions allowed regional regulators to comment on and approve the design, scale, placement, and impact of the facilities on their regions. Approval bodies included:

- Local Authorities of both Arkhangelsk Oblast and Severodvinsk City
- GosComEcology – both Arkhangelsk Oblast and Severodvinsk City Committees
- Local Authority of Primorskiy Krai Oblast
- GosComEcology – Primorskiy Krai Committee

No objections to construction of the LLRW facilities were identified. Three stipulations were identified including: 1) LLRW project must comply with RF and local environmental regulations and approval cycles, 2) the LLRW process must use advanced technologies, and 3) review organizations reserved the right of a re-evaluation of the LLRW facilities prior to operation. All Declaration of Intention documents were approved by October 1998.

Development of the Working Design and Final Design

The Working Design (WD) was begun shortly after contract award. The WD was the principle vehicle for eliciting and securing LLRW Project regulatory approvals. VNIPIET, designed the liquid LLRW systems, and the French corporation Cogema SGN designed the solid LLRW systems. VNIPIET re-packaged French design documentation to make the integrated WD appear to be seamless. The WD detailed the technical approach for the LLRW project (filtration, selective sorbents, etc.), and described how these processes would achieve volume reduction goals for wastes while simultaneously being compliant with RF statutes.

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The WD consisted of three separate but complete submittal packages, including Zvezda Storage Systems, Zvezda Treatment Systems, and Zvezdochka Treatment Systems. Each submittal consisted of 13 bound volumes and technical drawings. The WD identified that the subject technologies were already employed in Russia, and were ISO 9000 compliant when applicable. In addition, the WD detailed the ecological setting of the Zvezda and Zvezdochka shipyards and their processes, and how the LLRW systems would integrate with the shipyard without environmental impacts. The WD did not, however, include comprehensive design packages and drawings.

The Final Design was completed in parallel with the WD. Some preparatory construction took place during this time as well. Simultaneous efforts met with the intent of an integrated strategy toward regulatory compliance, approvals, and construction, and regulators agreed with the approach. Like the WD, the Final Design consisted of three separate but complete sets of albums and drawing packages. The Final Design did not require its own separate approval process. Approval of the Final Design was to be tacitly awarded as part of the training certification, systems qualification tests, radioactive waste management licensing, and issuance of sanitary passports.

Environmental Expert Reviews and Approvals

Environmental Review Authorization Orders for LLRW Project were established in April 1999. The Regional Far East offices of GosComEcology and Primorskiy Krai also chose to conduct separate environmental reviews of the WD. The Arkhangelsk Oblast and Severodvinsk City offices of GosComEcology accepted the review and decision of the central office, but reserved the right to re-evaluate the LLRW facilities prior to operation. Each board issued an approval with recommendations and conditions, which were negotiated by VNIPIET.

GosComEcology environmental expert review remarks, and associated VNIPIET responses were as follows:

<u>Comment</u>	<u>Response</u>
<ul style="list-style-type: none">• A radiological survey of treated sewage waters shall be conducted to ensure that levels of released tritium never exceed allowable levels	<ul style="list-style-type: none">• The radioactive treatment processes at both Zvezda and Zvezdochka will identify high tritium levels, which forces waste back through for reprocessing before any releases to the environment will occur. In addition, a modified waste water monitoring plan will be developed and approved prior to operation
<ul style="list-style-type: none">• Additional soil and sea sediment monitoring shall be conducted	<ul style="list-style-type: none">• This recommendation is intended to be incorporated into the final operational plans
<ul style="list-style-type: none">• An emergency response plan shall be developed	<ul style="list-style-type: none">• The existing site emergency response plans were offered as sufficient, and later accepted by GosComEcology

The Primorskiy Krai office of GosComEcology environmental expert review issued its own set of comments. The comments and associated VNIPIET responses for Zvezda were as follows:

<u>Comment</u>	<u>Response</u>
<ul style="list-style-type: none">• Submit additional pre-existing approved design documents, such as geologic, seismic, and waste water discharge data	<ul style="list-style-type: none">• This will be provided prior to facility operation
<ul style="list-style-type: none">• Additional seawater radiological monitoring shall be added to the monitoring plan	<ul style="list-style-type: none">• This will be negotiated and resolved prior to facility operation
<ul style="list-style-type: none">• Redesign the waste water discharge piping to have an outlet in the bay	<ul style="list-style-type: none">• This will be negotiated and resolved prior to facility operation

Working Design Reviews and Approvals

GAN coordinated the Inter-Ministry Centre for Expert Examination and Certification for Science, Engineering, and Surveillance for Nuclear and Radiation Safety (RES Centre) technical reviews of the WD. RES Centre is licensed by GAN to review radiation and nuclear safety designs. RES Centre is composed of nuclear power experts, GAN personnel, physics and engineering university researchers, and MinAtom personnel, and is utilized extensively in similar projects. The use of the expediting body RES Centre was crucial to this phase of the approval process.

GAN coordination shifted from its central offices in Moscow, to its Northern European District office in Saint Petersburg early in the WD approval cycle. The reasons for this transfer were not apparent, but LLRW project was not affected. WD approvals were granted by GAN on 25 May 1999 after several comments were incorporated:

- Working Design packages must be properly coordinated and approved in the established order
- The RF environmental expert review boards must approve the Working Design packages
- All participating entities must be properly licensed in the RF
- All certification documents for imported equipment must be submitted to GAN and ATOMCERTIFICA
- Solid waste labeling procedures were not specified and must be submitted in the operational manuals

Approval was also required by a broad array of local and federal bodies with responsibilities for similar projects. Multiple reviews required LLRW designers to address many comments, but no significant modifications were required in the Final Design. The WD was approved by GAN on October 1, 1999.

Ministry of Economy Expert Review

MinEcon appointed review boards to conduct comprehensive reviews on the three WD packages, and to evaluate and compare the recommendations and conclusions of all the other expert reviews, decisions, and license applications and approvals. The MinEcon expert reviews incorporated, by reference, all comments from other expert reviews, making their full resolution mandatory. MinEcon compilations included design and technical assessments; architectural and engineering materials; technical specifications; safety and public health data; quality assurance documents; inter-agency reports; environmental reviews; and GAN, and regional and environmental organization reports.

MinEcon compilations described the key objective of the LLRW Project as providing “modern, energy-saving technologies for processing liquid and solid radioactive wastes generated during decommissioning of nuclear power submarines.” The MinEcon report also elucidated key project milestones, design specifications, and operational parameters. These were categorized according to official RF technical and economic indexes for each facility, the waste to be processed, the staffing required, construction duration, and capital expenditures.

Specific new MinEcon requirements amounted to the need for constructing evacuation exits and verifying structural load-bearing ratings at Zvezda. MinEcon had also offered MinAtom the opportunity to conduct its own expert review, although MinAtom declined to conduct a review at this time. The Director of MinEcon approved the expert review comments on October 1, 1999, completing the reviews of the WD, and paving the way for completing construction, testing, and licensing of the LLRW facilities.

LICENSING AND CERTIFICATIONS

Licensing was a complex process requiring additional reviews, approvals, and permits for construction and operation of the LLRW facilities. Evolving regulatory processes within the RF complicated the entire licensing process. Navigating licensing and certification steps required some understanding of the rapidly changing licensing process, as well as continual interaction and negotiation with disparate agencies.

Equipment Certification

All LLRW equipment was declared by MinEcon to be exempt from customs duties, tariffs, licenses, and certifications, based on international nuclear weapons disarmament treaties. Equipment that ensured nuclear safety was classified as RF Category III nuclear safety equipment, and underwent nuclear equipment safety review. Documentation for five items of non-Russian Category III equipment required detailed review by the newly created

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Joint Certification Centre, ATOMCERTIFICA, composed of MinAtom, GAN, and Gostandart. Non-RF Category III equipment included:

- Low-Force Compactor (US design and manufacture)
- Sorting Box (French design and manufacture)
- Drum Dryer (US design and manufacture)
- Drums (US design and manufacture)
- High Integrity Container (French design and manufacture)

Certification of the non-RF equipment was complicated and the schedule was never fully elucidated. The LLRW Project team fostered constant dialog with individuals at ATOMCERTIFICA. As a result, no testing of equipment was required beyond factory tests, but reviews of design documents proceeded slowly. On-site certification was also considered. The equipment was ultimately shipped with the expectation that no interference with the systems qualification tests or final acceptances would occur, since any required testing would be performed on site.

Secondary equipment (known as complementaries, and including such items as gauges and hand tools) did not require certification apart from the equipment to which it was attached. In some instances, however, the local authorities or regional GAN might still require calibrations during the qualification testing phases or operations. Details of Equipment Certification for the subject LLRW facilities are the theme of Abstract #30, Paper #6 in the Waste Management 2000 Conference Proceedings.

Precursor Licenses

The Zvezda and Zvezdochka shipyards each obtained or held several licenses required as precursors to the LLRW project, including:

- Decommissioning and Dismantling License for Nuclear Submarines
- RF Equipment Design License
- RF Equipment Manufacturing License

These licenses demonstrate that each shipyard 1) has suitable equipment, facilities, operational and safety protocols, and sufficiently trained staff to carry out dismantlement operations, 2) has permission to design certain equipment, and 3) allows the manufacture of specific types of equipment. The shipyards utilized the purview of these licenses when constructing standard and nonstandard equipment (tanks, piping, support structures, etc.) for the project.

Additional perfunctory licenses were required. The Site Selection and Approval (Allocation) License application was submitted to Central GAN only after construction started. Oddly enough, granting of this license occurred after input from regional governments was incorporated, and well after construction started. The Construction License applications were also submitted to Central GAN only after construction began.

Training Certification

Each of the new LLRW facilities required trained operators before any additional licensing could proceed. Training on the Liquid, Laundry, Solid/Stabilization, Storage, and Radiation Monitoring systems constituted the core of LLRW training. In addition to subsystem training, requirements included orientations and demonstrations that were peripheral to the operation of the LLRW equipment. RF regulations also required amendments to existing radiation safety plans and to update radiation safety training to account for LLRW processes.

A general Training Plan that outlined development, approval, and conduct of all LLRW training at the Zvezda and Zvezdochka shipyards was drafted. The Plan ensured that shipyard workers and managers would be approved and capable of routine operations and maintenance of LLRW subsystems and processes, emergency procedures, and safety protocols. Each shipyard validated the Training Plan.

Training “Programs” were then developed, in close cooperation with the shipyard Training Department, from the operating instructions for each subsystem component. Programs defined pedagogical objectives and included training materials for subsystem operations, maintenance, optimization, safety and health, and emergency response.

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Programs conformed to customary yard specifications and formats for training program development including curricula, training hours (theoretical, familiarization, and practical), and level of training by employee classification.

Theoretical and familiarization training included classroom and hands-on instruction that immediately reinforced the knowledge. Once trainees passed a 15-minute oral examination, the shipyard recorded the results of the successful examination as a "protocol," and provided certificates entitling trainees to engage in practical training. Practical training was conducted by designers. Practical training lasted until the designer/instructor concluded that the trainees reached an appropriate level of competence. A final shipyard administrative approval was required to document that subsystem training was complete, and that the workers were fully certified/approved and eligible to conduct the "hot" systems qualification tests.

Radioactive Waste Management License

It is anticipated that both shipyards will submit the applications for their Radioactive Waste Management Licenses in the near future. The approval bodies are the regional GAN and environmental offices. This certification is an important prerequisite for the GAN permit for the hot systems qualification tests. This activity is not complete.

Systems Qualification Tests

Systems Qualification or Commissioning for LLRW project is not complete. Commissioning will generally follow the main provisions of SNIP 3.01.04-87 since more contemporary guidance was not available. The first step involves "cold" tests using surrogate non-radioactive, non-hazardous, waste in each subsystem to demonstrate its efficacy. The cold tests will be based upon engineering approaches and not regulatory requirements, and therefore generally do not include regulatory participation.

The results of system qualification cold tests will be compiled and presented to a newly formed Working Commission established by Order from each shipyard. The Working Commissions will include contractors and subcontractors, shipyard representatives, designers, State Sanitary Control, State Fire protection, various environmental bodies, and labor unions. The data will be evaluated, and the commission is expected to authorize "hot" testing (using actual LLRW) by decreeing the establishment of the State Commission. The makeup of the State Commission will be similar to the Working Commission with some additional organizations. Hot tests will be scrutinized by the State Commission. The Systems Qualification process is outlined in Figure 3.

Sanitary Passports

Sanitary Passports are needed for all facilities. The applications for Sanitary Passports will be submitted by the shipyards after systems qualification testing is completed, and prior to systems acceptance. The approval bodies include the national and local SanEpiNadzors. Obtaining Sanitary Passports was out of scope of the DTRA-funded LLRW project and have yet to be secured.

Operation, Maintenance, and Decommissioning Licenses

The applications for Operation and Maintenance Licenses were submitted to local GAN prior to final systems acceptance. Decommissioning of the facility and equipment are not required yet; these license applications must be submitted to GAN by both shipyards near the end of the facility life cycle, at least seven years from the present. Obtaining these were out of scope of the DTRA-funded LLRW project and have yet to be secured.

CONCLUSIONS

The methodologies and generalized procedures used in this project for certifying and licensing a nuclear facility in Russia are timely, and could be used successfully on other planned, or future, joint U.S.-Russian nuclear waste design-build projects.

Permitting and licensing these facilities was a complex challenge, involving coordination of multiple approvals undertaken within an evolving regulatory environment. The WD was the principle vehicle for eliciting and securing regulatory approval by GAN. Approval of the WD included independent reviews of the design for nuclear radiation safety by expert organizations licensed to review nuclear projects. Approval also included review of the projects by panels of experts in evaluating the environmental impacts of the proposed activities. Approval of the designs would

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not have taken place in such expedited fashion without constant interaction and coordination between designers and a broad array of local and federal entities.

Having a RF design agency which understood the approval process, and kept current of its almost-daily changes, facilitated the multitude of reviews and coordination of the WD, and few modifications were required. Expediting organizations were required in many cases to receive timely approvals. Initial phases of construction, including demolition and refurbishment activities, were carried out in parallel with the review and approval of the WD and the remaining licensing required. Facility approval, consisting of the operating permit, sanitary passport, and operating license, were to take place once operators were trained, and after installation and system “hot” tests were successfully completed.

FOOTNOTES

- (a) Lockheed Martin Environmental Services, Las Vegas, Nevada
- (b) Booz-Allen & Hamilton, Inc., McLean, Virginia
- (c) Booz-Allen & Hamilton, Inc., Moscow, Russia
- (d) Association ASPEKT, Moscow, Russia
- (e) State Unitary Enterprise All-Russian Design and Research Institute for Complex Power Technology, VNIPIET, St. Petersburg, Russia

REFERENCES

- (1) D. J. BRADLEY 1997, “Behind the Nuclear Curtain: Radioactive Waste Management in the Former Soviet Union.” Edited by D. R. Payson,. Battelle Memorial Institute. Battelle Press 505 King Avenue, Columbus Ohio, 716 pp.

Figure 1. Approval Process for Low Level Radioactive Waste Volume Reduction in Russia

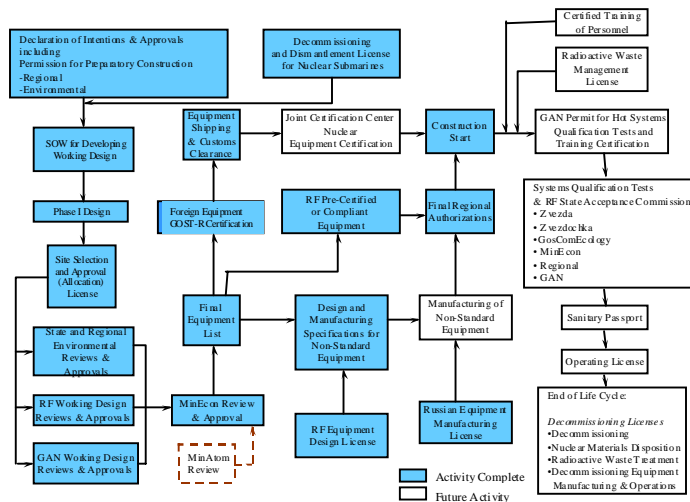


Figure 2. Russian Federation Review and Approval Bodies

<p>DECLARATION OF INTENTIONS</p> <p>Bokhoi Kamen Environmental Protection Committee Primorsky Krai Environmental Protection Committee Seveodvinsk Environmental Protection Committee Arkhangelsk Environmental Protection Committee Bokhoi Kamen Town Hall Primorsky Krai Administration Seveodvinsk Town Hall Arkhangelsk Oblast Administration</p>	<p>EQUIP CERTIFICATION</p> <p>Joint Certification Centre (Gostandart, GosAtomNadzor & MinAtom) NPP Standards Committee State Committee on Metallurgy RF Supervisory Authority for Mining and Industrial Safety (GosGortekhnadzor)</p>
<p>DEVELOPING WORKING DESIGN</p> <p>Northern European District Office of GAN Primorsky Krai Environmental Protection Agency Arkhangelsk Environmental Protection Agency Ministry of Economy (MinEcon) Ministry of Health, Sanitary & Epidemiological Supervisory Authority (SaRepidNadzor) Ministry of Natural Resource Protection</p>	<p>CONSTRUCTION LICENSE</p> <p>Federal Nuclear and Radiation Safety Authority of Russia (GosAtomNadzor, or GAN)</p>
<p>STATE ENVIRONMENTAL EXAMINATION (Ecological Expertise)</p> <p>State Committee of the RF for Environmental Protection (GosCmEology) Ministry of Health, Sanitary & Epidemiological Supervisory Authority (SaRepidNadzor) Far East and Siberian GAN Northern European GAN Arkhangelsk Region Ministry of Emergency Situations Seveodvinsk Fire Protection Inspectorate Seveodvinsk Town Hall Arkhangelsk Administration GosCmEology - Severodvinsk GosCmEology - Arkhangelsk Oblast GosCmEology - Primorsky Krai GosCmEology - Bokhoi Kamen Primorsky Krai Region Ministry of Emergency Situations Bokhoi Kamen Fire Protection Inspectorate Bokhoi Kamen Town Hall Primorsky Krai Administration</p>	<p>GAN HOST SYSTEMS PERMIT</p> <p>Varies with individual case, but for LLRW this includes: RF Ministry of Labor and Social Development - Labor Safety Inspection RF Fire Protection Inspection Agency (GosPozhNadzor) GosCmEology - Severodvinsk GosCmEology - Arkhangelsk Oblast GosCmEology - Primorsky Krai GosCmEology - Bokhoi Kamen Federal Nuclear and Radiation Safety Authority of Russia (GosAtomNadzor, or GAN)</p>

Figure 3. Systems Qualification Test Process

