

ECOLOGICAL MONITORING IN THE MOLIKPAQ AREA 1998 -2004







Sakhalin Energy THE NEW ENERGY SOURCE FOR ASIA PACIFIC

Underwater Pipeline

Monitoring programs



- Compliance monitoring (operation control on platform) permanent control on Molikpaq platform and FSO "Okha"
 - Air emission
 - Water consumption and discharge
 - Waste
 - Water quality in control zone (range 250 m)
- Impact monitoring (off-platform ecological survey)
 - Sediment quality
 - Benthos



General approach to monitoring



- Three phases
 - Pre-construction monitoring (June, 1988)
 - Post-construction monitoring (October, 1998)
 - Monitoring during exploration (October 1999 2004 annually)
- Comparability
 - Parameters
 - Methods of sampling and analysis
 - Season
- Adjustment of program
 - Changes in operation (water discharge, drilling)
 - Changes in parameters
 - Comments of control agencies
 - Comments of experts (Russian and international)



Compliance monitoring: general information



- The main goal is to be in compliance with
 - RF standards
 - International standards (World Bank Standards, MARPOL 73/78, USEPA 40, NPDES)

• Water Use License defines:

- Water Use Area
- Seawater consumption
- Wastewater discharge
- Pollutants discharge

• Water discharge includes:

- Sewage
- Oily wastewater,
- Drilling wastewater discharges
- Conditionally clean Cooling Water



Compliance monitoring: Drilling waste water





- Autumn 1998
 - ice-resistant platform Molikpaq was installed in the Sea of Okhotsk
- 1999 2000
 - Drilled 14 wells. Only water based mud was discharged.
- 2001
 - No Drilling activity
- 2000 2004
 - Implementation of the Pressure Maintenance Project: the Molikpaq platform upgrade and construction of 6 water-injection, 3 gas injection and 4 production wells.
- 2002 April 2004
 - Construction of upper level of wells (Water based mud used).
- May December 2004
 - Drilling, completion and installation of production X-tree (oily mud was used, all drilling waste were injected into on purpose prepared well).



Compliance monitoring: sewage pollutants





Total discharges of sewage pollutants – compliance with WUL

Reasons of accidental non-compliance:

- Phenols accuracy of analytic methods;
- Synthetic surfactants (laundry) –new
 Sewage treatment
 Plan is being
 commissioned.



Compliance monitoring:



Waste water discharge (thousand tons, sum of 1998-2004)



- Conditionally clean
 wastewater 99,7%
 - Cooling water
 - Brine from Desalting facility

- Polluted waste water 0,03%
 - Sewage 34,4%
 - Oil&grease 0.01%
 - Drilling mud&cuttings (water based) – 65,5%



Oily hydrocarbons concentration (µg per I) in water (250 m around Molikpaq)





- Background limits are <10-44 µg per l
- Maximal level was found in 1998 after platform installation
- The Amur river can influence on water quality around Molikpaq



Impact monitoring: Sampling parameters



- Grain size of sediment
- Pollution of sediment
 - Total petroleum hydrocarbons (PH)
 - Polyaromatic hydrocarbons (PAH)
 - Metals (AI, As, Ba, Cd, Cr, Cu, Fe, Hg, K, Mg, Pb, Zn)
- Benthos
 - Species diversity
 - Quantitative analysis
- Water samples in range of 250 m
 - nutrients (nitrate, nitrite, ammonia nitrogen, phosphate, silicon),
 - **BOD**₅,
 - -TSS,
 - PH, surfactants, total phenols,,
 - metals (K, Mn, Ba, Cd, Fe, Hg, Cu, As, Na, Ni, Pb, Zn, Cr, Mo, Co)







Impact monitoring: Station Locations





- West East 125, 250, 500, 1000, 3000 meters
- North South 125, 250, 500, 1000, 3000, 5000 meters
- Reference zone
 10 000 meters to South



Oily hydrocarbons content in bottom sediment (μg/g) in Molikpaq area and reference area





Barium distribution in sediments (acid dissolution method) in 1999 - 2003









Content of acid-soluble forms of Ba (μ g/g) in bottom sediments, 2004





Changes of grain size composition of sediment at different distances to the South from Molikpaq platform in 1998-2003







Changes of grain size composition of sediment at different distances to the North from Molikpaq platform in 1998-2003









Changes of grain size composition of sediment



- Platform influence (hydrodynamics)
 - annual variability near Molikpaq (125-250 meters range)
- Natural changes
 - annual variability at some other stations (500S, 500E, 1000N, 1000W, 3000N, 3000S
- Heterogeneity of bottom sediment (bottom surface inequality and accumulation process)
- Variability caused by methodical reasons (samples and analysis methods)



Gross content of Ba (µg/g) in bottom sediments in Molikpaq platform area and Reference zone





- 1998-2000
 method of
 complete
 dissolution
- 2002-2004 method of alkaline alloying
- Correlation R=0.81
- Background data 240-1500 μg/g



Benthos biomass changes in 1998 – 2004 in Molikpaq area and Reference area







Variability of total biomass of benthos





- Annual changes in ecosystem
- Changes in sediment grain size
- Variability of duplicates for every station



Composition of benthos





Molikpaq area several dominant groups

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- Echinoidea
- Cumacea
- Actinaria
- Bivalvia
- Polychaeta
- Amphipoda
- Gastropoda
- Reference area
 two dominant
 groups
 - Echinoidea
 - Cumacea



Number of benthos species







Conclusions



- Chemical parameters of water in the range of 250 m around Molikpaq are in compliance with background characteristics for the region
- Grain size of sediment is very changeable due to natural condition of hydrodynamic activity
- Operations of Molikpaq and SALM did not lead to increase of PH content in sediments. Existing levels of PH content in sediments cannot affect the biota.
- Operations at Molikpaq and SALM did not cause changes in metal content in sediments. Existing Ba concentrations are comparable with the background data.
- Distribution of benthos organisms near Molikpaq platform, SALM and reference stations is very non-uniform, which is result from heterogeneity of sediments.
- Benthos composition and qualitative parameters are changeable due to natural reasons (sediment variability, heterogeneity of distribution, annual trends)
- Methods of samples and data analysis need further improvement

