A Return to the Nuclear Waste Dumping Sites in the Bays of Novaya Zemlya

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INTRODUCTION

The White Book 3 published by Russian authorities in 1993 documented the dumping of substantial quantities of solid nuclear wastes into shallow bays located along the margin of the islands of Novaya Zemlya (70-80° N, 50-70° E). Nuclear reactor compartments, ships, a submarine and containers of low level radioactive waste were found at these locations although reconnaissance efforts failed to locate the nuclear icebreaker LENIN reactor compartment and packing with spent nuclear fuel, reportedly dumped in Tsivolki Bay. In 1993, 137Cs contamination levels in surface sediments of Tsivolki Bay ranged from 4-30 Bq/kg, and were similar to the levels typically observed in the open Kara Sea (2-33 Bq/kg). Expeditions to Stepovogo (1993/94) and Abrosimova (1994) Bays revealed that sediments from seafloor locations near reactor compartments and other dumped objects did not contain appreciably elevated radionuclide concentrations. However, near-surface sediments located near leaking low level radioactive waste containers were highly-contaminated. Close to the waste containers, surface sediment 137Cs levels were as high as 110,000 Bq/kg in Stepovogo Bay and 8400 Bq/kg in Abrosimova Bay, with traces of 60Co.

In addition to the 1993-1994 expeditions, a survey was conducted in 2002 for Abrosimova Bay under the auspices of the International Science and Technology Center (ISTC). Survey results (Nikitin et al., 2005) indicated that 137Cs, 90Sr and 239+240Pu levels in surface bottom sediments of the major part of the Abrosimova Bay did not exceed 40, 2.5, and 1.2 Bq/kg d.w. respectively (except samples taken in close vicinity to dumped objects). A new survey, jointly organized by Russia and Norway, was conducted in 2003 and 2004. The survey re-assesses the artificial radionuclide contamination levels in bottom sediments in the Novaya Zemlya Bays: Tsivolki, Stepovogo and Abrosimova.

MATERIALS AND METHODS

Sampling procedures

Surface (0-2 cm) sediment samples were collected with a box-corer (0.1 m^2) or by grab "Ocean" (0.25 m^2) at 29 stations located in the dumping areas (Tsivolki Bay, Stepovogo Bay and Abrosimova Bay) and at one station located in the Novaya Zemlya Trough (Figure 1). All samples were frozen onboard at -20ºC and stored frozen until analysis.

Analysis procedures

^{137}Cs, ^{238}Pu and $^{239+240}Pu$ measurements in surface bottom sediment samples were performed by SI RPA Typhoon.

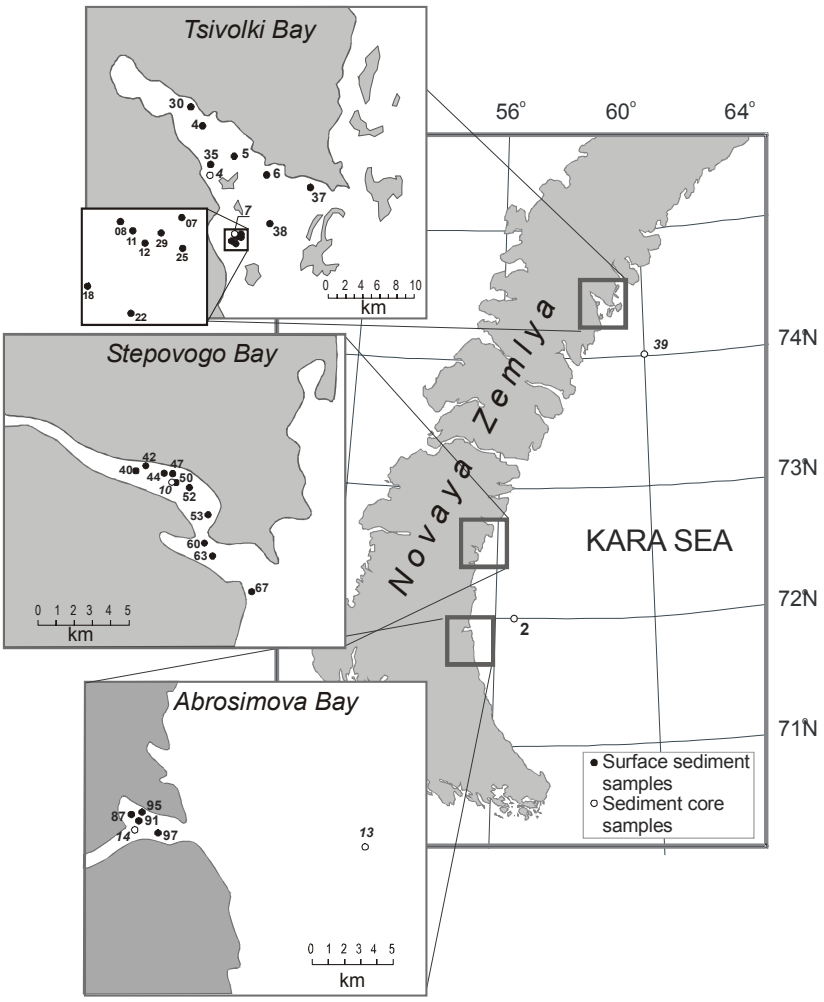

Figure 1. Sediment sampling sites, 2003-2004.

RESULTS AND CONCLUSIONS

In this new assessment, ^{137}Cs contamination levels have diminished appreciably within both Stepovogo and Abrosimova Bays and there has been no detectable leakage from objects in Tsivolki Bay. Near-surface sediment contamination levels in 2003/04 are 1-11 Bq/kg, 4-268 Bq/kg, and 13-20 Bq/kg in Tsivolki, Stepovogo and Abrosimova Bays respectively. Hence, leakages from the low-level waste containers on the seafloor have diminished appreciably since 1994 while sediment reworking (e.g. mixing, burial, resuspension and transport) and radioactive decay has reduced considerably the elevated radionuclide levels previously detected in surface sediments. Furthermore, there is no indication that nuclear fuel from the dumped reactors or submarine has been or is presently releasing detectable quantities of radioactivity into the marine environment. These conclusions are further supported by the data for ^{238}Pu and $^{239+240}Pu$ (Table 1).

Table 1. Activity of ^{137}Cs, $^{239+240}Pu$ and ^{238}Pu in surface (0-2 cm) bottom sediments from the eastern Novaya Zemlya bays and Novaya Zemlya Trough, 2004. Range, mean (M) and standard deviation (S.D.)

Area	Valid number	^{137}Cs, Bq/kg dw	Valid number	$^{239+240}Pu$, mBq/kg dw	Valid number	^{238}Pu, mBq/kg dw
		Range		Range		Range
		M ± S.D.		M ± S.D.		M ± S.D.
Tsivolki Bay	15	1.4-11.5	15	60-480	1	<4.4-66.3
		6.2 ± 3.5		178 ± 107		
Stepovogo Bay	10	4.4-268	10	271-1103	5	<7.8-354
		54.7 ± 77.6		619 ± 292		105 ± 141
Abrosimova Bay	4	13.4-21.9	4	403-1040	3	<18.4-112
		18.6 ± 3.6		632 ± 280		62.6 ± 44.0
NZ Trough	1	11.0	1	439	0	<16.4

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