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VIIMSI OIL TERMINAL, VIIMSI VALD

N-TERMINAL REVIEW

Report prepared by Golder Associates Oy

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Golder Associates Oy
Kutomotie 9 C
FIN-00380 Helsinki
FINLAND

Tel +358-0-5611588
Fax +358-0-558651

CONTENT

Golder Associates Oy
Kutomotie 9 C
FIN-00380 Helsinki
FINLAND

Tel +358-0-5611588
Fax +358-0-558651

1. INTRODUCTION

Golder Associates Oy was asked to make a review and a site visit concerning the oil terminal in Viimsi in the northern border of Tallin in Estonia. The aim of this review and site visit was to give an opinion of the situation in the area and to propose the future remedial and protection works for the area mainly concerning the soil and groundwater contamination and to propose the monitoring and protection of the soil and groundwater during the operation of the oil terminal.

2. REVIEW

Viimsi oil terminal is located on Viimsi peninsula at the northern border of Tallin in Estonia. Viimsi terminal was used as a storage terminal for diesel oils and for the gasoline since 1956 to 1994. Terminal has several above ground storage tanks, four underground experimental storage rooms, and three large underground storage tunnels. Facility has also the loading harbor area for tankers at the off-shore as well as the loading areas for railroads and lorries.

Planning works for the oil terminal was started in 1956 in the northern part of the area where the experimental oil storage area is located. Construction works were started at 1962 and the first experimental underground storage tank was also taken in use at 1962. The experimental underground storage area had four underground storage rooms of total volume of 1 400 m^3. Mainly for diesel fuels in storage no 26-2 and gasoline (A 66) in storage no 26-3 those two others storage no 26-1 and 26-4 were used for different experimental purposes. After 1972 experimental storages were not in use for oil products, sometimes they were used by army for oil waste.

The underground storage facility plans was started 1962 and the construction works were started in 1964. Underground storage tunnels were taken in use in 1971 with a total storage volume of about 50 000 m^3. These storage tunnels were used for the diesel oil storage in two tunnels and gasoline (A 72) storage in one of them. During the last two years only diesel and heating oil was stored in the underground tunnels.

Accordingly to the inventory made at 1993 there was found in use 117 above ground storage tanks with a volume of about 3 600 m^3 mainly for the diesel storage purpose and 100 above ground storage tanks out of use.

Accordingly to the review and investigations done in the area there are six main areas already notable contaminated by the oil product handling in the area. These areas are as follows:

1. The railroad loading area.
2. Loading area for the tank cars.
3. Loading place for the heating oil.
4. The landfill area.
5. The experimental storage area.
6. Rain water discharge area

These locations can bee seen in the areal maps over the terminal area in MaVes reports. During the review there was taken soil and ground water samples in the area. This review was done by MaVes Ltd between may and july in 1994.

Golder Associates Oy
Kutomotie 9 C
FIN-00380 Helsinki
FINLAND

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Fax +358-0-558651

This sampling indicates that soils are affected and in those six places contaminated by the oil products. Accordingly to the Dutch list, the C-level areas are about 1 400 m^2 . The contamination is located in the top soils maximum of 1 m in depth and as a average depth of 0,5 m. This gives a natural soil volume of about 700 m^3. The B-level area is about 1 000 m^2 which gives the total volume of about 600 m^3.

Groundwater was sampled and analyzed in six deep wells in the terminal area. These wells were existing deep wells and not made during the review. All these wells takes water in the deep aquifer which is called cambrian vent (Cm-V). The deep aquifer is well isolated from the contamination in the overburden. Isolation is made of 30 to 40 m thick clay layer of so called blue-clay. Water samples give the results concerning the total hydrocarbon content which is less than the detection level for the method used, i.e. < 3 μg/l, for all the samples. These groundwater samples detect that neither the underground storage tanks nor the above ground storage tanks have been affecting the main deep aquifer.

Waters which are affected by the oil products are surface water in ditches, the drainage water from the area and the top soil groundwater in sandstone layers near by the experimental storage area. The surface waters are drained in to the Gulf of Finland via two drainage systems from the area. One of these drainage ditches is located in the western part of the area and the other one in the eastern part of the area.

Information got during the review accordingly to the TSCUGI, 1993, indicates that the area round the experimental storage area have contaminated waters about 70 to 100 m from the facilities mainly in the sandstone layers in the clay.

3. SITE VISIT AND INTERVIEW

The site visit and the interview was made 3th of may 1995 together with Tõnu Elme, managing director of Petroen Ltd and Madis Metsur, managing director of MaVes Ltd.

Site visit started with a review of the situation and the plans for the terminal and continued with a walkover survey and interviewing.

Tank car loading place was the first visited place. This place was paved and equipped with a drainage and underground oil separation system before waters are to be lead in to the canalization and out from the area.

The underground storage facility was visited and accordingly to the information it has been used for the diesel oil and heating oil storage purpose lately and one of the storage caverns was used as a gasoline storage. Pumping, and pipeline shaft in the end of the northernmost storage was visited and accordingly to the information the facility is ready to be used. No leakages was noted in the underground facility equipment.

Next place to visit was the railroad loading area. The old loading area was contaminated and in need of investments to avoid migration downstream in the ditch system. Accordingly to the information a lot of natural bioactivity has taken place in the ditch system already and the situation has became much better compared with the contamination level during the MaVes review and sampling campaign in 1994.

Next place was the above ground storage areas in two places along the railroad loading

Golder Associates Oy
Kutomotie 9 C
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FINLAND

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area which still had a lot of several kind and quality of old steel storage tanks which were not in use. These areas did have a surface spill and need actions.

Experimental underground storage area with four storage facilities was visited next. This area have accordingly to the information contaminated soils and groundwater above the thick clay layer. In the uppermost part of the clay the horizontal sand lenses and layers are the main pathways for the contaminants. During the site visit some experimental remediation was taking place in this area concerning the ground water.

Heating oil loading area was the next place to visit as well as the different above ground pumping and drainage places. All these areas were affected by spills and accordingly to the information from the sampling campaign also contaminated in the top soils by oil products.

The main problem is the area around the visited oil terminal landfill. This area is leaking the oil products in the drainage ditches where already some protection system was installed. Accordingly to the information several tons of oil products have been gathered with the existing oil separators in the ditch system.

4. SOIL AND GROUNDWATER SITUATION

All the before named contaminated and affected areas were walked over during the site visit. Notable during this walkover was the railroad and tank car loading areas which were modernized and paved and equipped with oil separators and underground drainage system. Two of the areas mentioned in review were notable contaminated, the first was the ditch system from the old railroad loading place down streams, and the second one was the landfill area and the ditch system downstream.

All the named six places needs actions to avoid migration of the contaminants. Specially the surface waters need the protection system to avoid migration to the Gulf of Finland. The underground storage facility do not have any notable affects in the cambrium vent deep groundwater laying below the clay. No samples are taken in clay, where these storage tunnels are located. Taken samples are from close located existing groundwater wells, locations are presented in MaVes report.

Soil contamination in the area is mainly concentrated in the top soils. Only the areas where soils are cut by man made constructions are potential problems for the migration of the contamination in deep soils and ground water. Identified such a places are, the experimental storage area, existing monitoring and surveying holes and the shafts for the communication to the underground storage. All the area have from the natural migration point of view a good protection down, which is made of the existing blue clay of 30 to 40 m in thickness. Horizontal migration is not a large problem in soils because of low gradients and the soil resistivity.

The groundwater situation in the area have been controlled in the main aquifer which lies below the clay layer. This control shows that no migration taken place in to that formation. So far the under ground facility has been used for the oil storage purpose or just been empty. During these situations the gradient has been in to the facility, so the migration out is avoided. If the storage is filled with water, the existing natural gradients takes over and the migration occurs accordingly to that, i.e. down in to the high permeability aquifer and in that along the aquifer depending on the gradients caused by

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the water intakes near by.

Surface water and ground water above the clay and in the existing horizontal sand layers in the top clay have a migration process which causes the contaminant spreading so far the gradient is not changed in to the storage rooms.

5. PLANS FOR THE FUTURE - PROPOSAL FOR THE ENVIRONMENTAL ACTIONS

Accordingly to the proposed actions by MaVes Ltd. all the contaminated areas need to bee treated but to start with the works which are aiming to avoid the further migration.

After the review and discussion the following actions are proposed:

1. All the existing drill holes for the monitoring and survey purpose must be located and depending on the construction maintained or sealed off to avoid migration along the casing. All new monitoring holes need a construction which avoids the communication along the casing.

2. The experimental storage rooms must be emptied from the oil products and oil contaminated waters. These storage rooms should be kept empty. Inleaking water amounts in these storage are calculated to be small after these are emptied. The inleaking volume and quality of that water together with the monitoring information gives the input for the final remedial design for this area. When the gradient is changed into the storage rooms the migration out is avoided.

3. All the oil waste must be taken care of to avoid further spreading. The main such places are existing storage tanks, pipelines and underground drainage systems which are not emptied.

4. Environmental management of the oil terminal must be stated and taken in use for the future as well as for the remedial period. Statements of the land use for the future before planning the remedial actions are needed mainly to choose the operation fields for the treatment of soils and to put the target values for the area.

5. Monitoring of the area before, during and after the remediation to state the impacts in the soil, groundwater and air.

6. Removal of the old oil storage tanks and new building of the storage area accordingly to the plans stated.

7. Rebuilding of the drainage system and the oil separating system and other treatment systems for the drainage waters from the area.

8. Contaminated soil remediation, about 800 m^3 of soil needs to be treated. The planning and realizing the remediation and the monitoring and control of the remedial works.

9. Existing drainage ditch remediation, mainly the area for the railroad loading and other drainage structures contaminated accordingly to the review.

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6. MONITORING OF THE AREA

Oil terminal in Viimsi, N-Terminal, is planning to store about 100 000 m^3 of gasoline, 300 000 m^3 diesel and heating fuels and 100 000 m^3 jet fuel annually. Storage rooms needed are the underground facility of about 50 000 m^3 where mainly diesel and heating oil is planned to be stored. For the diesel and heating oils there are plans to construct seven 3 000 m^3, four 5 000 m^3 for gasoline and two 5 000 m^3 tanks for jet fuel. These tanks are planned to be accordingly to the international storage standard to minimize the losses of the products.

For the planning, remedial and operation purpose, this area needs a monitoring program to be able to follow the changes and impacts of the different phases of the development of the terminal. The monitoring program is consisting of the six separate parts concerning the following:

1. Monitoring of the surface water downstream the facility in two different drainage canales from the area. The area is drained via the so called eastern and western drainage systems. These drains needs a control to state and avoid the impacts today and during the remediation and during the operation of the oil terminal.

2. Monitoring of the impacts round the experimental storage area. The first thing is to state the impacts today before the final planning of the remediation in this area. The main objects is to monitor the sand formations in the top clay and topsoil groundwater.

3 Four monitoring points in the main aquifer to state the impacts of the whole area but also to state the potential impacts of the under ground storage tunnels in that aquifer. This monitoring gives information also if some other migration pathway is existing down in to the main aquifer.

4. Monitoring of the underground storage impacts in the clay near by the tunnel system. This monitoring program gives the information of the migration and gradient situation round the tunnel system and helps in understanding of the situation round the under ground storage facility.

5. Harbor area sea water monitoring program. This gives information on changes in the sea water at the facility.

6. Air monitoring program to follow the impacts in the air and control the different parts of the facility.

7. CONCLUSIONS

Accordingly to the review done and the information gathered for this summarizing we can consider Viimsi area as a suitable area for oil storage purpose and as a future oil terminal for the Northern Estonia.

All the future above ground storages, loading and unloading areas for oil products will be planned accordingly to the international standard which makes the storage to fill up all environmental demands. The underground facility is made in very good and safe

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formation from the environmental view, which means that together with the proposed environmental monitoring program it will full-fill the future environmental standards and can be taken in use as a storage room for the oil products.

The proposed environmental management for the terminal will make the handling of products and the control of the facility to the level which is used internationally.

Management of the existing problems accordingly to the planning will stop the migration of the existing contaminants and after the remediation the area can again be classified as a non contaminated area.

Ongoing planning works for the infrastructure will provide more information for the sea transports as well as for the land transports.

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Golder Associates Oy

Yrjö Lintu
Senior Hydrogeologist
Managing Director

Golder Associates Oy
Kutomotie 9 C
FIN-00380 Helsinki
FINLAND

Tel +358-0-5611588
Fax +358-0-558651

KOKKUVÕTE JA SOOVITUSED

Viimsi kütusehoidla põhiterritooriumi keskkonnareostuse kaardistamisel määrati reostuse ulatus nii pinnases, pinnavees, pinnasevees ja põhjavees.

Pinnasereostus. Eraldati 5 ala, kus pinnase naftareostus nõuab reostunud pinnase vahetamist ja puhastamist. Reostunud on **735 m³** pinnast **1375 m²** maa-alal. Reostunud pinnas sisaldab **88 tonni** naftaprodukte. Maa-alal oleva isetegevusliku prügimäe piirkond, mis on masuudiga reostatud, vajab eraldi lahendust, sõltuvalt edasisest maakasutusest.

Pinnaseveereostus levib 1..2 m paksuses maapinnalähedases veekihis reostatud pinnasega aladel. Reostatud aladelt äravoolav reostunud pinnasevesi tuleb koguda ja juhtida läbi õlipüüdja.

Pinnavesi kanalites, kraavides, tiikides ja basseinides sisaldab igal pool naftaprodukte. Kraavidele on paigaldatud lihtsad õlipüüdjad, ka lagunevad naftaproduktid pikal territooriumi-sisesel vooluteel, seepärast on veejuhtmete väljumisel kütusehoidla territooriumilt naftaproduktide sisaldused alla 0,2 mg/l. Pinnaveed, mis praegu voolavad läbi reostunud prügimäe ala, tuleb juhtida prügimäest mööda.

Kogu endise baasi territooriumi planeerimiskava koos pinnavee ja drenaaživee ärajuhtimisskeemiga tuleb lahendada kompleksselt. Läbi puhastite tuleb juhtida kõik endise sõjaväeosa territooriumi reostunud aladelt valguvad pinna-, pinnase- ja põhjaveed. Seni on vajalik jätkata praeguste õlipüüdjate kasutamist.

Põhjavesi. Katsešahtide alal on lontova sinisavide peal lasuva lükati veehorisondi põhjavesi naftaproduktidega reostunud vähemalt 100 m raadiuses. Reostus on alguse saanud katsešahtidest, kus hoiti algul naftaprodukte ja kuhu valati hiljem jääke. Katsešahtide proovitühjendamise (ca 1000 m^3 vett) ja taastunud vee kvaliteedi uuringute järel tuleb leida šahtide puhastamise ja likvideerimise lihtsaim moodus.

Suurte maa-aluste kütusehoidlate ümbruses olevatest kasutatavatest sügavatest puurkaevudest võetud neljakordne proovivõtuseeria näitas, et lontova sinisavide all lasuvad **kambrium-vendi veekompleksi veed on puhtad.**

Reostuse levikut võivad soodustada **maa-alused kommunikatsioonivõrgud**. Torustike ja drenaaživõrkude seisundit tuleb pidevalt jälgida, naftaproduktide avastamisel need koheselt puhastada, mittevajalikud süsteemid sulgeda, vajalikud korrastada.

Uuringute käigus **leiti 4 puurauku**, mis ei kõlba vaatluskaevudeks ning vajavad likvideerimist. Leidmata jäi puurauk nr. 32, puuritud 1980 a. ja mis dokumentide järgi on vaatluspuurauk (26 m ulatuses läbib kambrium-vendi veekompleksi).

Kütusehoidla **maapealne mahutitepark** ei vasta keskkonnakaitsenõuetele ning tuleb täielikult rekonstrueerida.

Olmereoveed juhitakse praegu puhastamata loodusesse. Edaspidi tuleb kanalisatsioon lahendada nõuetekohaselt.

Viimsi kütusehoidla territooriumil on vaja teha ulatuslikke korrastus- ja puhastustöid, kuid tööde mahud pole ülejõukäivad. Kasutatavat põhjavett kütusebaasi (sealhulgas maa-aluste mahutite) nõuetekohane kasutamine ei ohusta. Kõik maapealsed rajatised tuleb ümber ehitada, millega on ka alustatud. Merevee kaitse peab tagama läbimõeldud drenaaž koos õlipüüdjate (õlipuhastite) süsteemiga.

10.	Existent gum content, mg/100 ml	max 5
11.	Oxidation stability	min 530
12.	Benzene content, vol–%	max 5
13.	MTBE, vol–%	max 12
14.	Appearance	clear and bright
13.	Colour	undyed

2. Kaubakäive

2.1. Import (tuhat tonni)

Produkt	1995	1996	1997	Transport
Bensiin	–	30	100	tanker (raudtee)
Diiselkütus	75	200	200	raudtee (tanker)
Gasoil (LKG)		170	100	raudtee
Reaktiivkütus (lennukipetrool)			100	raudtee
KOKKU:	75	400	500	

2.2. Eksport (tuhat tonni)

Produkt	1995	1996	1997	Transport
Bensiin	–	–	60	raudtee
	–	30	40	autod
Diiselkütus	–	110	110	tanker (raudtee)
	75	90	90	autod
Gasoil (LKG)		170	100	tanker
Reaktiivkütus (lennukipetrool)			100	tanker
KOKKU:	75	400	500	

3. Normatiivne baas

Euronormid *"European Model Code of Safe Practice in the Storage and Handling of Petroleum Products"* Part II: Design, Layout and Construction.

API–650 *"Welded Steel Tanks for Oil Storage"*. American Petroleum Institute

Soome Vabariigi normid:

SFS-3350 *"Palavien nesteiden varastopaikka ja siellä olevat palavan nesteen käsitelypaikat."*

SFS-3355 *"Palavien nesteiden käsiely satama-aluella. Lastaus- ja purkamislaittesto."*

SFS-3356 *"Palavan nesteen putkisto."*

SFS-3357 *"Palavien nesteiden varaston sammutus- ja torjunta-kalusto."*

4. Terminaali töökorraldus

Terminaali töö korraldamiseks on ette nähtud rekonstrueerida olemasolev raudteelt mahalaadimise sõlm. Tehnoloogilise programmi kohaselt on võimalik tsisternidest maha laadida kõiki terminaalis käsitletavaid produkte. Raudteetsisternidesse väljastamiseks on vaja välja ehitada korralik tsisternide täitmise estakaad kahel raudteeharul. Raudteitsi on kavas väljastada kõrgekvaliteetseid diiselkütuseid ja bensiine. Üheaegselt on võimalik teenindada 2x9 raudteetsisterni.

Autotsisternidesse väljastatakse diiselkütuseid ja bensiine. Autodele laadimise sõlm on projekteeritud 8 autotsisterni (4 tk. bensiinide ja 4 tk. diiselkütuste) teenindamiseks. Olemasolev ajutine autodele laadimise sõlm likvideeritakse tulevase terminaali generaalplaani kohaselt.

Laevadele laadimise seadmed paiknevad põhivariandis Miiduranna sadamas olemasaoleval kail nr. 1 või 3. kai juurde ehitataval naftakail (jetty'l). Laadimissõlmes on võimalik nii tankeritele laadimine kui ka tankeritelt mahalaadimine, samuti väikelaevade punkerdamine. Alternatiivvariandis on vaadeldud ka ühendusvõimalust Muuga sadamaga.

Olemasolevad kolm maa-alust mahutit á 17,500 m³ on kavas kasutada riigireservi (diiselkütuse) säilitamiseks; seepärast on nende aastase käibe koefitsiendiks arvestatud 1,5. Diiselkütuste ja gasoili (LKG) jooksva käibe korraldamiseks on ette nähtud ehitada 7 maapealset reservuaari mahuga á 3000 m³.

Aastase summarse kaubakäibe 300 000 t/a juures on arvestatud projekteeritavate diiselkütuste ja gasoili reservuaaride käibekiirusena 13,5 korda aastas.

Reaktiivkütuste (lennukipetrool) tarbeks monteeritakse 2 reservuaari mahuga á 5000 m³. Aastase kaubakäibe 100,000 t/a juures kujuneb käibekoefitsiendiks 6,5.

Bensiinidele on ette nähtud monteerida kokku 4 reservuaari mahuga á 5000 m³. Aastase kaubakäibe 100,000 t/a juures on käibekoefitsient 6,5.

4.1. Hoolduse- ja kontrolli põhimõtted.

Terminaali hooldamise, teenindamise ja remondiga tegeleb ainult spetsiaalse väljaõppe saanud

personal, kes kogenud dispetseri järelvalve all kannab regulaarselt hoolt süsteemi korrasoleku eest.

Terminaali juhataja (või tema asetäitja) vastutab seadmete korrasoleku ning teostatavate hooldus- ja remonttööde ohutuse ja kvaliteese teostamise eest. Hooldus- ja remonttööde kohta tehakse sissekanded vastavatesse dokumentidesse ja aktidesse.

Vähemalt kord vahetuses toimub kogu süsteemi ülevaatus, avastamaks võimalikke lekkeid ja muid rikkeid. Lekke korral tuleb selle põhjus koheselt kõrvaldada ning mahavoolanud produkt eemaldada.

Pideva kontrolli all hoitakse toruarmatuuri ning torustiku ja voolikute ühenduskohti. Kõik voolikud peavad vastama ohutusnõuetele, olema töökindlad ja vajadusel toestatud, vältimaks lubamatuid läbipaineid. Voolikud peavad vastama käsitletavale produktile ja kasutatavale survele. Surveproov 1,5 kordsel töörõhul korraldatakse kord aastas.

Magistraaltorustikud on varustatud kaitseklappidega, mis võimaldab ülesurve tekkimisel juhtida osa produktidest drenaažpaaki. Torustike tühjendamine ja puhastamine toimub produkti vahetamisel.

Laevade laadimiskohtadele suunduvate torustike tühjendamiseks on ette nähtud võimalus kasutada "põrsast", mis surugaasi abil liikudes tühjendab toru drenaažpaagi suunas. Torustiku läbipuhumiseks on ette nähtud toru otstesse kamber "põrsa" sisenemiseks ja väljumiseks ("pigtrap").

K–1 klassi produktide torustikke puhutakse läbi lämmastikuga, ülejäänud produktide puhul võib kasutada suruõhku.

4.2. Reostuse vältimine sadamas

Naftareostuse vältimiseks ja võimaliku avarii puhul päästetööde teostamiseks on vajalik kavandada vastavad meetmed. Arvesse tuleb võtta mitmeid tegureid, mis mõjutavad kaitsemeetmete iseloomu:

- väljaõppinud tööjõu olemasolu ja reservid;
- tehnilise varustatuse tase;
- päästemeetodite valik;
- tööde juhtija ja õigete koostööpartnerite valik;
- õppetreeningute läbiviimine;
- investeerimise ja kahjude kompenseerimise kord;

Naftasaaduste lekke korral peab rajatise valdaja koheselt asuma avarii likvideerimisele ning seejärel teatama maakonna keskkonnaosakonnale ja päästeametile. Laadimisplatsi, hoidla või tankla omanik peab omama avariide likvideerimise kava, mis on kooskõlastatud päästeameti ja maakonna keskkonnaosakonnaga ning peab tegema kõik endast sõltuva, et pidurdada reostuse levikut ja koguda laialivalgunud naftasaadusi.

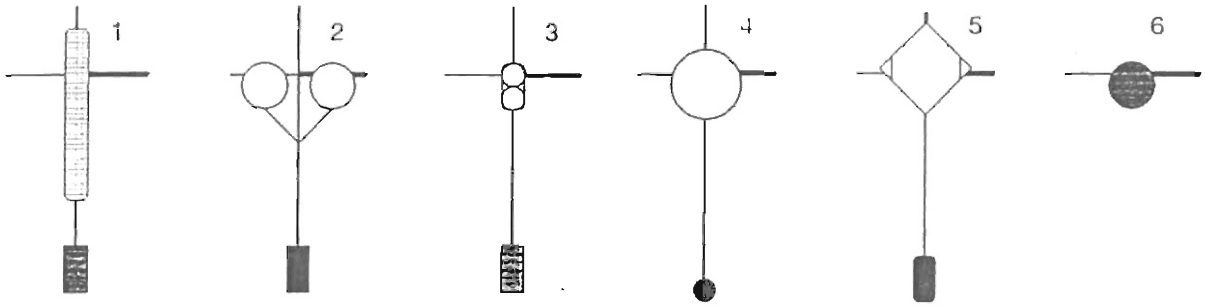
Keskkonna reostamise korral hüvitab objekti omanik kahjude hindamise ja likvideerimisega seotud kulud ning tasub saastekahju hüvitise, kui on toimunud veekogu või pinnase reostus,

kehtiva seadusandluse kohaselt.

Põhilisteks vahenditeks veekeskkonda sattunud naftaprodukti de leviku tõkestamisel ja reostuse likvideerimisel on naftapoomid. Poome on mitmesuguse konstruktsiooniga, kuid nende tööpõhimõte on üks: kasutades ujukit ja vastukaalu püstitatakse veepinnale nafta laialivalgumist takistav tõke.

Joonisel on näidatud põhiliselt kasutatavad poomitüübid:

1) aedpoom, vahtplastist ujukiga
2) aedpoom, õhupallitaoliste ujukitega
3) aedpoom, ujukiks õhuga täidetud plasttoru
4) suruõhuga täidetud kummi- või plastkeha
5) plastikust isetäituv mahuline poom
6) imav poom, täidetud naftat absorbeeriva materjaliga



Joonis.2. Enamlevinud poomitüübid.

Kõige tavalisemad poomid on valmistatud PVC-kangast, kõrgusega 1 meeter ning sektsiooni pikkusega 25 m. Merre paigaldatuna ulatub see veepinnast kõrgemale ca 25–30 cm.

Olgu poomi tüüp milline tahes, tuleb täpselt jälgida selle vettelaskmise ja kinnitamise korda. Tavaliselt ei piisa ühekordsest poomitamisest, vaid poomtõkkeid tuleb paigaldada mitmes reas.

Päästetööde teostamiseks vajalikud seadmed, päästevahendid ja -materjalid on küllaltki kallid ja nende õige valik nõuab kompetentsust antud alal, seetõttu tuleks kaaluda Tallinna ja Muuga lahe piirkonnas naftasaaduste transportimisega tegelevate firmade ühise finantseerimise abil ühtse päästeteenistuse loomist.