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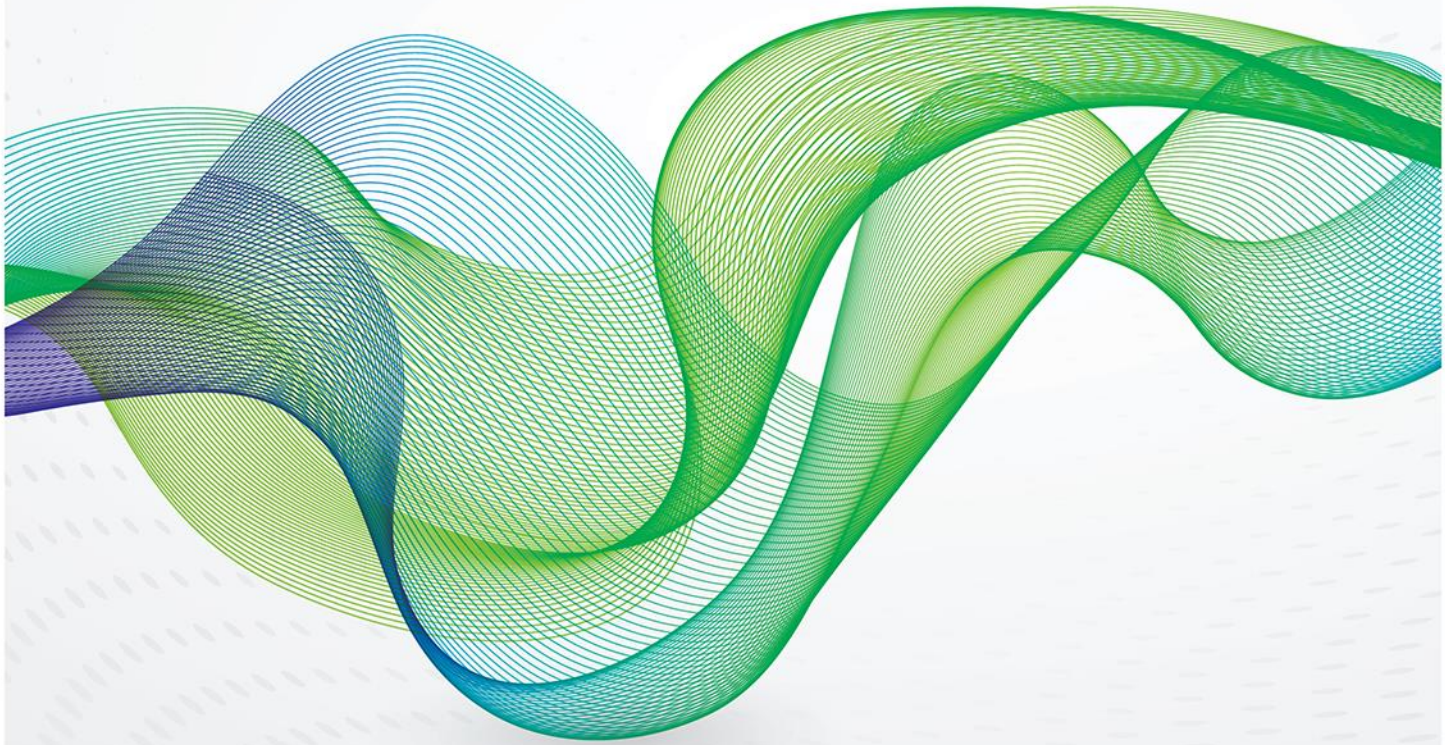
The Domino Effect: contaminated oil in the Druzhba oil pipeline – implications of the incident for Russia and Europe



OXFORD ENERGY COMMENT

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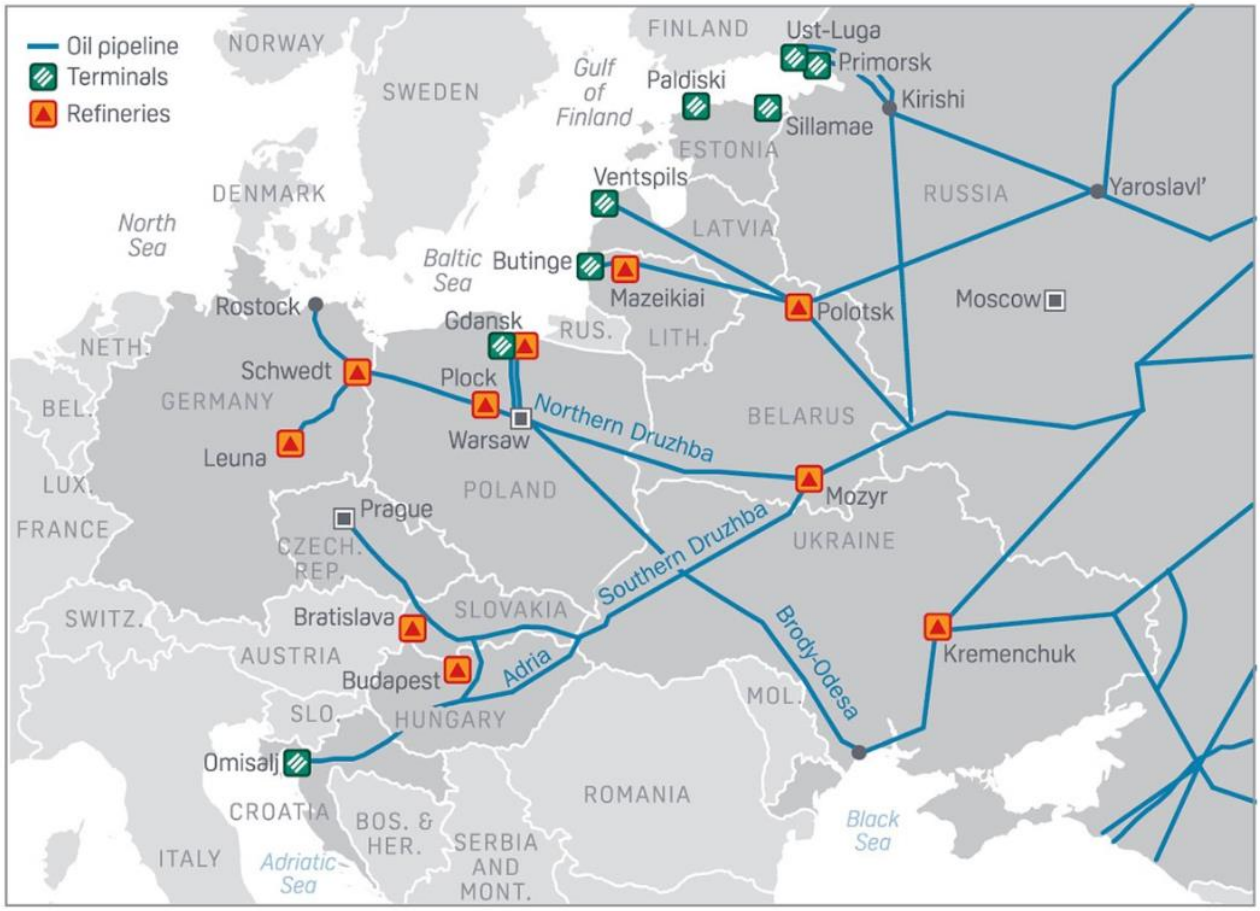
I. Red light for Druzhba crude deliveries

Since 19 April 2019, refiners in Central and Eastern Europe have been on high alert. Contamination of oil with organic chlorides in the Druzhba – or 'Friendship' – trunk pipeline (one of the main inland routes for delivery of Russian crude to refineries in Eastern and Central Europe, with daily export flows of circa 1 million barrels) led to a halt in operations for both branches of the Druzhba pipeline network by 25 April. The Druzhba pipeline has a capacity of between 1.2 and 1.4 mb/d in its different sections and is the longest trunk oil pipeline system in the world. It originates in Almetievsk (Tatarstan) in the Volga region in the south-eastern part of European Russia. From there, it runs about 1,500 kilometres to bring crude to Belarus (Mozyr refinery). The pipeline then forks into:

- The Northern branch that feeds refineries in Poland (Plock and Gdansk) and Germany (Schwedt and Leuna);
- The Southern branch that feeds refineries in Hungary (Duna), Slovakia (Bratislava), and the Czech Republic (Litvinov and Kralupy).

Extensions to the Druzhba network reach out as far as the Adriatic port of Omisalj in Croatia. The distances between Mozyr and the end points of the Druzhba pipeline in Europe are in the range of 1,000–1,500 kilometres. The combined refining capacity of plants in Europe linked to the Druzhba network is over 1.8 mb/d, with most of their feedstock being delivered by this pipeline (see Figure 1).

Figure 1: Main oil pipelines and key refineries in Central and Eastern Europe



S&P Global Platts, ©2019 by S&P Global Inc.

High levels of organic chlorides[1] are extremely dangerous for refining equipment. In high temperatures (above 200 degrees Celsius) chlorides start a chemical reaction and form hydrochloric acid, which severely corrodes refining equipment. Chlorides also drastically lower the efficiency of catalysts. Under normal temperatures, dichloroethane does not represent an immediate corrosion risk for oil pipelines. But oil contaminated with a high concentration of organic chlorides is unsellable, as no buyer would want to deal with this off-spec product. In order to bring the contaminated product to the required condition, it must be diluted with large amounts of 'clean' crude.

The first alarm call came on 19 April from Gomeltransneft, the operator of the Druzhba pipeline in Belarus. According to Gomeltransneft documents, tests by Belarus on oil received from the Druzhba pipeline showed organic chloride levels at 150–330 parts per million (ppm) between 19 and 22 April; this level was up to 30 times the maximum 10 ppm concentration allowed by Transneft specifications.[2] Gomeltransneft sent out letters to its Druzhba counterparts in Poland and Ukraine about the contamination problem. On 22 April, tests taken at Adamovo in Poland also showed the concentration of organic chlorides was 30 times more than the norm. Poland's state-owned oil pipeline operator PERN suspended the flow of crude oil via Druzhba to Poland to protect its domestic transmission system and refineries. Meanwhile, flows to the Southern leg of Druzhba in Ukraine continued until the evening of 25 April, when they also were suspended, by Ukrtransnafta, the operator of the Ukrainian section of Druzhba.

As the quality checks continued, contaminated oil was found in Belarus, Poland, Germany, Ukraine, and the Baltic port of Ust-Luga, all of which have connections to the Druzhba network. The Ust-Luga oil terminal in the Gulf of Finland is fed by the newly built 0.72 mb/d pipeline known as Baltic Pipeline System-2 (BPS-2), in operation since 2012. This branch (going north from the Unecha pipeline junction on the Russia–Belarus border) was built by Russia to bypass Belarus and increase the capacity of Russia's Baltic Sea terminals.[3]

At the time of writing, estimates of the amount of oil contaminated with chlorides differ. According to Gomeltransneft, the Belarus section of Druzhba contains about 120,000 tons of contaminated crude, and about 50,000 tons are in the Russian section.[4] Reuters have reported that at least 10 tankers, with a combined 1 million tons of contaminated oil, have already sailed from Ust-Luga. Moreover, Reuters reported that, as of 29 April, the levels of chlorides at Ust-Luga were still at 80 ppm, eight times above the norm.

Neither Transneft nor Russia's Ministry of Energy has provided an official assessment of the total contaminated volume. News reports based on speculative estimates have mentioned figures as high as 5 million tons.[5] A simple assessment of the recent reported flows in the Druzhba system and the number of days that contaminated oil could be pumped through its different parts suggests much smaller tainted amounts, on the order of 1.3 million ton (See Tables 1 and 2).

[1] The non-spec substance discovered in the Urals blend flow via Druzhba on 19 April was identified as dichloroethane.
[2] 'How Russia contaminated $2.7 billion of oil exports to Europe', Reuters, 30 April 2019, https://www.reuters.com/article/us-russia-oil-insight/how-russia-contaminated-27-billion-of-oil-exports-to-europe-idUSKCN1S61YM.
[3] Ust-Luga is a large new Russian port on the Baltic Sea, located 120 kilometres from Saint Petersburg. In 2018 it handled almost 100 million tons of cargo, including 27.8 million tons of crude oil and 29.6 million tons of refined products. In addition to the oil terminal, in the vicinity of the port there is a landing point for the 55 Bcm per annum Nord Stream-2 gas pipeline (currently under construction) and also the sites for both a planned 10 million ton per annum Baltic LNG plant and a 45 Bcm per annum gas processing plant.
[4] 'Clean oil will not arrive at the Mozyr refinery not earlier than May 4 – Belneftekhim', BELTA (News of Belarus), 30 April 2019, https://www.belta.by/economics/view/na-mozyrskij-npz-chistaja-neft-postupit-ne-ranshe-4-maja-belneftehim-345936-2019/.
[5] 'How Russia contaminated $2.7 billion of oil exports to Europe', 30 April 2019, https://www.reuters.com/article/us-russia-oil-insight/how-russia-contaminated-27-billion-of-oil-exports-to-europe-idUSKCN1S61YM.

Table 1: Reported pipeline flows of crude oil in the Transneft system by export destination (including transit)

	Q1-2019 (mb/d)	Mar-2019 (mb/d)
Novorossiysk (Black Sea)	0.54	0.56
Northern Druzhba	0.72	0.68
Southern Druzhba	0.27	0.28
Ust-Luga (Baltic Sea)	0.61	0.65
Primorsk (Baltic Sea)	0.78	0.82
Kozmino (Pacific Ocean)	0.63	0.62
China (via Kazakhstan)	0.20	0.21
China (ESPO)	0.60	0.57
Total exports	4.37	4.39

Source: Author, data from Argus

Table 2. Preliminary assessment of contaminated volumes

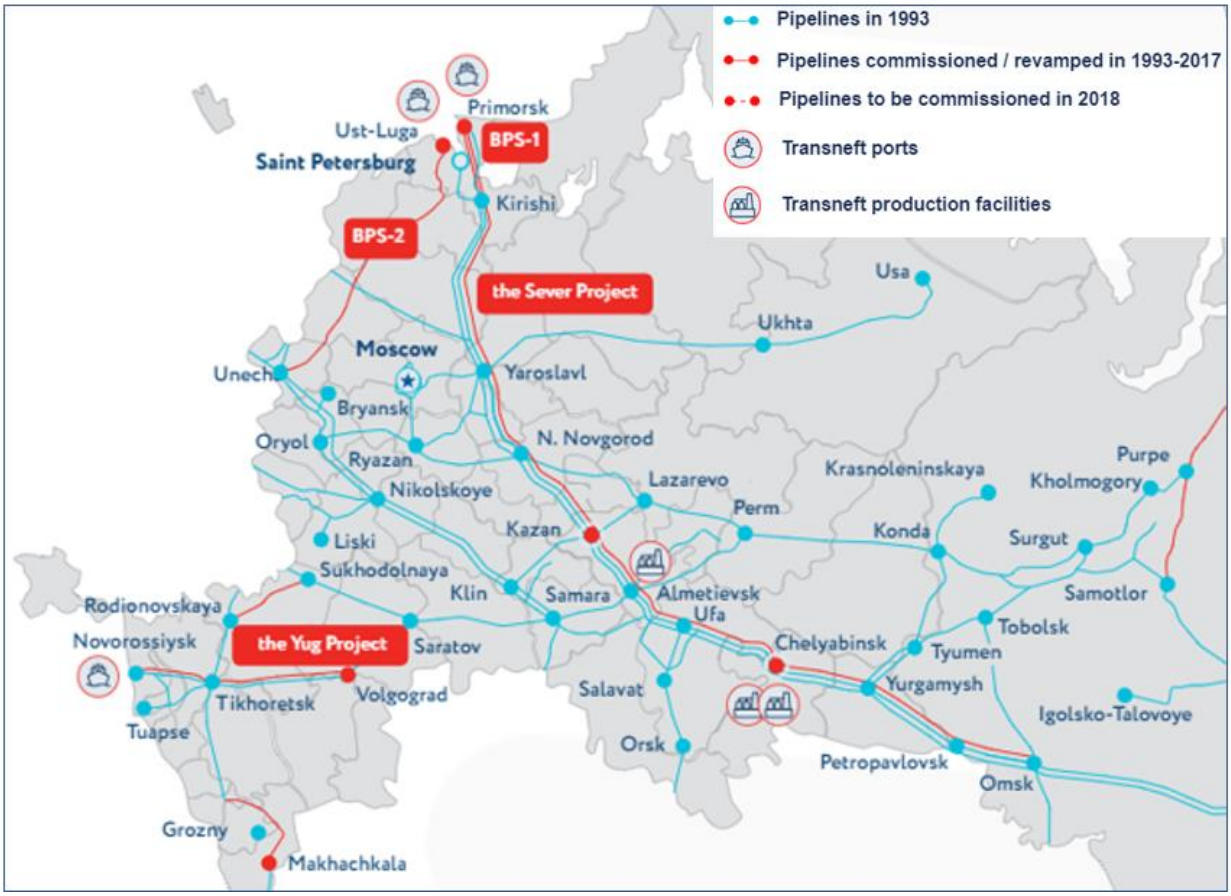
	Number of days accepting contaminated crude	Flow (mb/d)	Total (million barrels)
Northern Druzhba	4	0.68	2.71
Southern Druzhba	7	0.28	1.97
Ust-Luga	7	0.65	4.58
Total (million barrels)			9.26
Total (million tonnes)			1.27

Source: Author's calculation

II. The Transneft pipeline system: some background

Druzhba is an extension of the vast Russian oil pipeline network and was built in the early 1960s to supply the East European countries of the Soviet bloc. Transneft's integrated network of large-diameter pipelines is the largest in the world. It has been the workhorse of the Soviet economy, and later of the Russian economy. The Western part of the system connects the main oil provinces in Western Siberia, Volga–Urals, and Timan–Pechora with domestic refineries, seaports, and inland export pipelines (see Figure 2). Since the early 2000s, Russia has been expanding the eastern part of the Transneft system; this now exports crude oil to China and delivers crude to the sea port of Kozmino near Nakhodka in Russia's Far East.

Figure 2: Transneft pipeline system: Western part



Source: Transneft

Transneft's pipeline system: key characteristics

- Regulated pipeline operators for crude oil (Transneft) and refined products (Transnefteprodukt) were combined into one company in January 2008.
- As of 2018 the company operates approximately 68,400 km of trunk pipelines and is the world's largest pipeline operator.
- Transneft's crude oil pipeline system is operated by 12 regional subsidiaries.
- Transneft's crude oil pipelines transported about 480 million tons of crude oil (83 per cent of Russia's total production) in 2018.
- Transneft's product pipelines transported 39.2 million tons of light refined products (30 per cent of Russia's total production of light products) in 2018.
- For crude oil, pipe diameters range from 420 millimetres (mm) to 1,220 mm; the system also includes:
  - 500 pumping stations;
  - 871 storage tanks with a total capacity of about 24 million cubic metres (MMcm).
- In 2018 Transneft's throughput amounted to 480 million metric tons (mt) compared with 460 mt in 2008.
- Deliveries in 2018 comprised 250 mt to Russian refineries, and about 230 mt of exports.

Russian oil trunk pipelines are regulated by the state, since they are deemed to be an infrastructural ('natural') monopoly. Transneft, a 100 per cent state-owned company, is a common carrier operating on a set tariff regulated by the state.

Russian oil producers usually do not have long-term contracts with Transneft. Instead, oil producers submit their requests for the volumes they intend to produce and the destinations to which they want to ship. Determination of the allocation of capacity is then subject to a complicated procedure involving Transneft and the Ministry of Energy. Based on information provided by the oil producers, and pursuant to the Natural Monopoly Law, Russia's Ministry of Energy annually allocates Transneft's available capacity to oil producers for export deliveries, with quarterly and monthly allocations. The shippers receive the schedules in advance. Once allocated, oil producers generally cannot increase their allotted capacity in the export pipeline system. However, they can seek to alter delivery routes and can assign their access rights to others.

The procedure for crude oil injection into the Transneft system

Crude oil is delivered into the Transneft system through a network of collection and metering points (uzel ucheta nefti). There are about 150 such points in Russia. Most of them belong to the large oil producers who are responsible for ensuring that crude oil meets the required specifications and standards. In the old oil province of Volga–Urals, with its proliferation of hundreds of small-scale producers, many of the metering and collection points that are responsible for relatively small injections of crude into the Transneft system have been managed by private companies.

Every time a producer delivers crude oil into the Transneft system6 samples of the injected crude oil are taken and stored (similar to the way anti-doping agencies test athletes for the use of forbidden substances). These crude oil samples are then tested in chemical laboratories at the collection and metering points, to make sure that the quality and specifications of the volumes delivered to Transneft correspond to the standards established by the state. For large-scale producers, the pumping of crude oil into the Transneft system is a non-stop process. If the chemical analysis demonstrates deviation from the required standards in one of the samples taken during the day, additional testing is performed. If the problem is confirmed, the intake is stopped and the producers are required to bring their crude to the standard parameters before Transneft starts accepting it again. The system of checks applied to the crude oil injected into the Transneft system, in theory, allows the origin of any tainted crude to be identified, and its producer to be established. The trail of documents should go back to the source of produced crude since the regulations require demonstrating that the oil was legally extracted.

The quality specifications for crude oil are outlined in Russian State Standards (GOST, in Russian).7 There is a special Russian State Standard for the procedure used to determine the content of organic chlorides in petroleum.[8] According to this established procedure, chemical analysis of samples from the metering stations takes place daily for sulphur and paraffine contents, but only once in ten days for organic chlorides content. The drawings from daily samples of crude taken over ten days are mixed in equal proportions for the organic chlorides test, which involves the spectral analysis of naphtha derived from fractionation of the samples.

The key parameter of interest for the Druzhba pipeline has been the level of sulphur content, as the Urals mix specifications have an upper limit of 1.8 per cent. Indeed, most recent concerns about Urals quality have been focused on the rising sulphur content in Druzhba, as sweeter Russian crude has been channelled towards China. Transneft has very limited ability to transport individual batches of crude oil. This results in the blending of crudes from different fields and from different producers with varying characteristics. Transneft does not operate a quality bank system that would compensate better quality crude oil producers at the expense of the poorer quality producers. Since a lot of Druzhba crude originates in Tatarstan and has high sulphur content, the reduction of sweeter West Siberian crude flow westward has been a challenge for Transneft (see Table 3).

[6] At every collection and metering point there is a tank farm. The largest ones have a capacity of 50,000 tons.
[7] Russian State Standard 51858-2002 'Petroleum. General technical characteristics'. Retrieved from https://minenergo.gov.ru/node/1650.
[8] Russian State Standard 52247-2004 'Petroleum. Methods for determination of organic chlorides'. Retrieved from https://minenergo.gov.ru/node/1651.

Table 3: Sulphur content for main Russian oil pipeline export routes

Destination	Maximum allowed sulphur content, %	Actual sulphur content, %, year 2015	Predicted sulphur content, %, year 2019
Novorossiysk-1	1,8	1,35	1,5
Novorossiysk-2	0,6	0,56	0,6
Primorsk	1,8	1,55	1,7
Ust-Luga	1,8	1,68	1,8
Druzhba	1,8	1,68	1,8
ESPO (including spur to China)	0,65	0,6	0,65

Source: Author, data from Russia's Ministry of Energy

If for any reason the measured results of the samples do not correspond to the requirements, intake is stopped and the producers are required to bring their crude to the required parameters before they can ship it. This system assumes that producers would exercise control over the key quality parameters, as any interruption of deliveries would be extremely costly for them.

III. The mysterious case of Transneft contamination

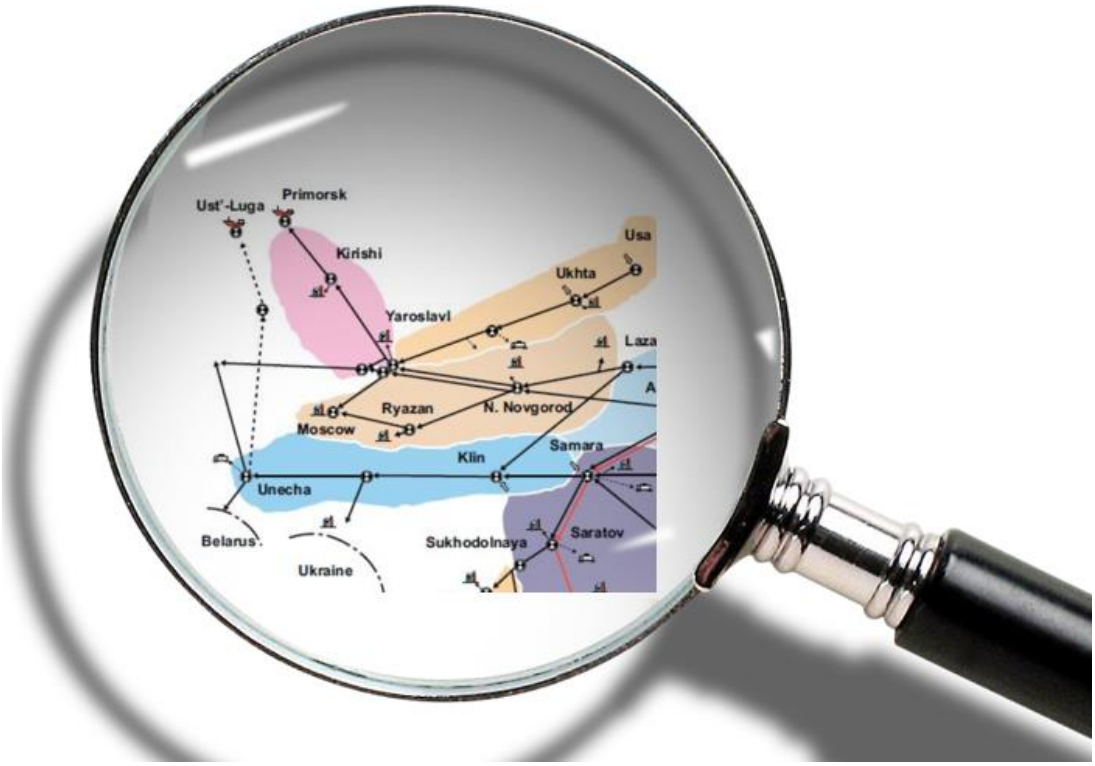
The system that had rested on the principle of self-control of crude quality by producers, and that had worked for Transneft for many years, has failed. The contamination of crude oil with organic chlorides in the Transneft system is an unprecedented event. In the company's 27-year history, this is the first crude quality incident on such a scale. Once contaminated oil was discovered in Belarus, it was clear that it had originated in the Russian section of the Druzhba pipeline operated by Transneft. The sampling system should have prevented the contamination and established its source, but it did not. Moreover, three weeks after the incident neither the exact cause nor the culprit is known.

Transneft recognized the quality problem soon after Belarus raised the red flag, but it appears that the magnitude of the contamination came as a total surprise. Confusion and poor communication on the part of Transneft have contributed to uncertainty and speculation in both the press and social media. Transneft identified the segment of its pipeline system having anomalously high concentration levels of organic chlorides as the Samara–Unecha section; it then narrowed the search to the specific entry point. This was identified as a small oil collection and metering station in Samara region (see Figure 3).

The injection point where the contamination originated is in the section of Druzhba that lies beyond the spurs to several large refineries in Samara region. Indeed, there are no other refineries on Russian territory along this route for the next 1,300 kilometres as this flow is export-oriented. As a result, the only refinery whose equipment suffered damage was Mozyr in Belarus, the first on this route. Whoever injected the contaminated crude into the system was probably hoping that it would get diluted on the way. But it did not.

This is where things become more mysterious. Transneft named a private company 'Samara transneft terminal' as an owner of the metering station, only to learn that this company had sold the station in 2017. The new owner, the limited liability company 'Nefteperevalka' (with a charter capital of 10,000 rubles, a mere $150), collects crude oil delivered by trucks from four small independent producers in the region, checks its quality, issues the necessary papers, and then injects it into the Transneft system. It appears that the quality checks at this collection and metering point were either ignored or were happening irregularly. Transneft now calls the incident a 'fraudulent scheme'. Russia's Federal Security Service (FSB) is conducting a criminal investigation of the case.

Figure 3: Samara–Unecha section of the Transneft network



Source: Author, data from Transneft

On April 30 a local Samara web-portal carried an article that pointed to the FSB searches at the offices of a small local oil producer “Volga Oil” and some unidentified refinery. The publication suggested that under the fraudulent scheme the good quality crude at one of the tanks at the metering station was taken out and sold to the refinery, processed, and the money for the sale of refined products pocketed. Then the missing volumes at the metering station were replaced with crude contaminated with organic chlorides.[9]

Meanwhile, as the investigation continues, several hypotheses about the origin of the vast amount of dichloroethane injected into the pipeline system have emerged in the press and in social media. Some of these point to an act of sabotage. Another theory suggests that some oil producers used dichloroethane to enhance oil recovery and then the improper quality crude was injected into the system. Mikhail Khodorkovsky, the former head of Yukos that had production assets in Samara region (currently owned by Rosneft), wrote a commentary in his Facebook account in which he said that organic chlorides could be used by oil producers to enhance oil recovery and then the contaminated oil could have been injected into the Transneft system without proper preparation and removal of the chlorides, via the small rural metering point. Khodorkovsky recalled that the restriction on usage of organic chlorides in oil production was removed in 2012 by the Russian Ministry of Energy as part of the plan to promote EOR programmes.

Another explanation that might be quite plausible also appeared on Facebook and it came from Gazpromneft chief of strategy Sergey Vakulenko (he stated that it was his personal theory and not a company position). According to Vakulenko, dichloroethane could be used to clean the well-bore zone by one or several producers; this is common practice, especially when the extracted oil contains paraffine that tends to block the pores. After the cleaning procedure, oil extraction starts again, and the first portion of the produced oil that gets mixed with the dichloroethane (where dichloroethane might represent up to 30 per cent of the mix) is usually drained into a sludge pit or tank. It could be that oil

[9] http://samara.ru/r/kto_isportil_rossiyskuyu_neft_v_nefteprovode_druzhba_-105932

contaminated with chlorides from such a sludge pit was illegally sold cheaply as furnace fuel to be used in some rural boiler houses. And after the end of the heating season, this oil (which had probably changed hands several times, with new buyers being aware that it was off-spec, but probably not realizing that it contained chlorides) might be brought by several trucks to the metering station in Samara region and injected into the storage tanks there under forged documents. It could then be fed into the pipeline over a couple of weeks, which might help explain why the contaminated oil was not a single batch with a super-high concentration of chlorides, but a relatively large volume with 100–300 ppm concentration in different parts of the flow. The critics of this hypothesis pointed to the fact that dichloroethane is quite expensive (at least ten times more expensive than crude oil), and it would not be very wise for anyone to use it to remove paraffine from the well-bore zone.

An obvious question to ask is: what quantities of crude contaminated with dichloroethane were injected to cause the contamination to become so huge? If one assumes that the maximum volumes of tainted oil reported in the press at 5 million ton are correct and applies to it the reported 330 ppm content of organic chlorides registered in Belarus, the volume of dichloroethane in the system comes to an enormous amount of 1,650 tonnes, or an equivalent to 50 large oil tanker trucks of pure dichloroethane (or 150-200 oil tanker trucks if one assumes 30% content of dichloroethane in the tainted oil). This might seem as too large an operation to come unnoticed and undetected. If, however, one uses more conservative estimates of the total amount of contaminated crude at about 1.3 million ton and applies lower average concentration of organic chlorides to it, then the amount of dichloroethane ends up in the range 200-400 tons. For this amount, the turnover number of oil tanker truck deliveries of the contaminated substance (assuming 30% concentration of dichloroethane and an oil tanker with capacity of about 30 tonnes) could be 20-40[10]. This is still very significant but could be managed by a single oil tanker truck over the course of two weeks, if one assumes 2 or more deliveries per day. The above back-of-the-envelope calculation makes the hypothesis of the forgery by some individuals that wanted to make money on the side appear more plausible.

In any case, the above theories remain speculative. The investigation by Russia's FSB is ongoing, and owing to the high profile of the case, is likely to be pursued very actively.

IV. President Putin: 'The system must be changed'

As the scale of the problem became apparent at the end of April, President Vladimir Putin summoned Transneft head Nikolay Tokarev.[11] The minutes of this meeting, that took place on 30 April, provide important information about the systemic causes of the problem and the likely ways they are going to be addressed.[12]

When Tokarev characterized the injection of out-of-spec crude as a 'fraudulent act', Putin asked: 'Does Transneft control at all the quality of oil that enters into the system?' Tokarev's explanation about private companies making the quality checks on behalf of Transneft obviously was not satisfactory for Putin. 'Someone did the fraud, but it is us who are going to deal with the damage – monetary and reputational. The system of self-control failed. This system must be changed.'

In Russia, it pays to listen to what President Putin says. The new procedures will likely tighten control and quality checks for the producers. If Transneft ends up taking the collection and metering stations that now belong to the oil companies and private businesses onto its books, these additional costs would be included into the pipeline tariff.

[10] The amount of contaminated crude in Belarus was officially reported as 170 thousand tons and the range for the concentration of organic chlorides at 150-330 ppm. The concentration levels of organic chlorides in Ust-Luga were reported at 80-100 ppm.

[11] Tokarev, currently 68 years old, is one of President Putin's closest allies. He has been the head of Transneft since 2007, and the head of Zarubezhneft prior to that. Their acquaintance goes back to the 1980s when Tokarev served with Putin in the KGB office in Dresden, East Germany.

[12] 'Meeting with the head of Transneft, Nikolai Tokarev', Kremlin, 30 April 2019, http://kremlin.ru/events/president/news/60424.

IV. The long and painful return to specifications

There is no easy way to remove chlorides from crude oil. Instead, the contaminated oil can be gradually diluted with 'clean' crude to reach the required specification levels. Indeed, that's what Russia has proposed as a solution to the problem.[13] But, as always, the devil is in the details. In order to dilute the contaminated oil, it is necessary to obtain large quantities of clean oil. With regards to the out-of-spec crude that had been shipped out of Ust-Luga, the buyers of the shipments – Total, Vitol, Glencore, and Trafigura among others – will now have to store the oil somewhere in Europe and gradually dilute it. It is not clear at this point who is going to foot the bill for these additional costs and losses. The situation with the contaminated crude in the Druzhba system is even more complicated. In order to bring clean crude, the flow in the pipeline must be restored. But to do that, the contaminated crude must first be removed from the system and stored at tank farms. Where this is not possible, it will have to remain in sections of the pipeline that would be used as temporary storage. After several days of consultations, Belarus and Russia agreed on a plan that would push the contaminated crude into the tank farm at the Mozyr refinery; clean crude from Russia would then arrive by pipeline, with some also arriving by rail. The rail cars then would be used to take the contaminated crude and ship it out to the points where it could be diluted.

According to the latest reports, the special cleaning batches have been used to push out the contaminated oil from the Belarus section leading to the Mozyr refinery. The removal of the 'bad' crude was taking place in two directions: 50,000 tons were pushed out of the pipeline and stored in oil tanks at the Unecha metering station at the Russia–Belarus border, while 120,000 tons have been stored in oil tanks at the site of the Mozyr refinery. In its place 'clean' crude from Russia is going to reach Mozyr refinery on 4 May.[14] After the resumption of refinery operations, the contaminated volumes from the oil tanks will need to be gradually diluted to arrive at the required 10 ppm content of organic chlorides. According to the Belorussian side, it will probably take several months to get rid of the contaminated crude altogether. It was reported that one of the options considered was to transport the contaminated crude by rail to Russia's Black Sea port of Novorossiysk where it could be diluted and added in small amounts to the export mix.

Dealing with the contaminated oil locked in the Northern and Southern legs of the Druzhba is going to be another challenge. One leg of the Druzhba pipeline (it is not clear at this point whether this will be the Northern branch leading to Poland and Germany or the Southern branch leading to Ukraine, Hungary, Slovakia and the Czech republic) is likely to become the temporary storage point for the contaminated crude, while the other would get cleaned and resume operations. In practical terms, the details would probably depend on the level of cooperation between the countries linked by the Druzhba system regarding the available tank farm capacity along the way and their willingness to temporarily store the contaminated crude. This will then be either gradually added to the clean flow in the Druzhba pipeline, or removed by rail shipments and sent to the Black Sea ports for the continuation of the dilution process there.

The plan agreed between Russia and Belarus, after a high-level delegation from Russia's Ministry of Energy (headed by Deputy Energy Minister Pavel Sorokin) had come to Mozyr, generally follows the logic described above. On 4 May, clean oil from Russia arrived at the metering station at Mozyr, and the Mozyr refinery is supposed to resume operations on Monday 6 May. The Russian side has promised to bring the quality of crude oil at Ust-Luga to the required norm by 7 May.[15]

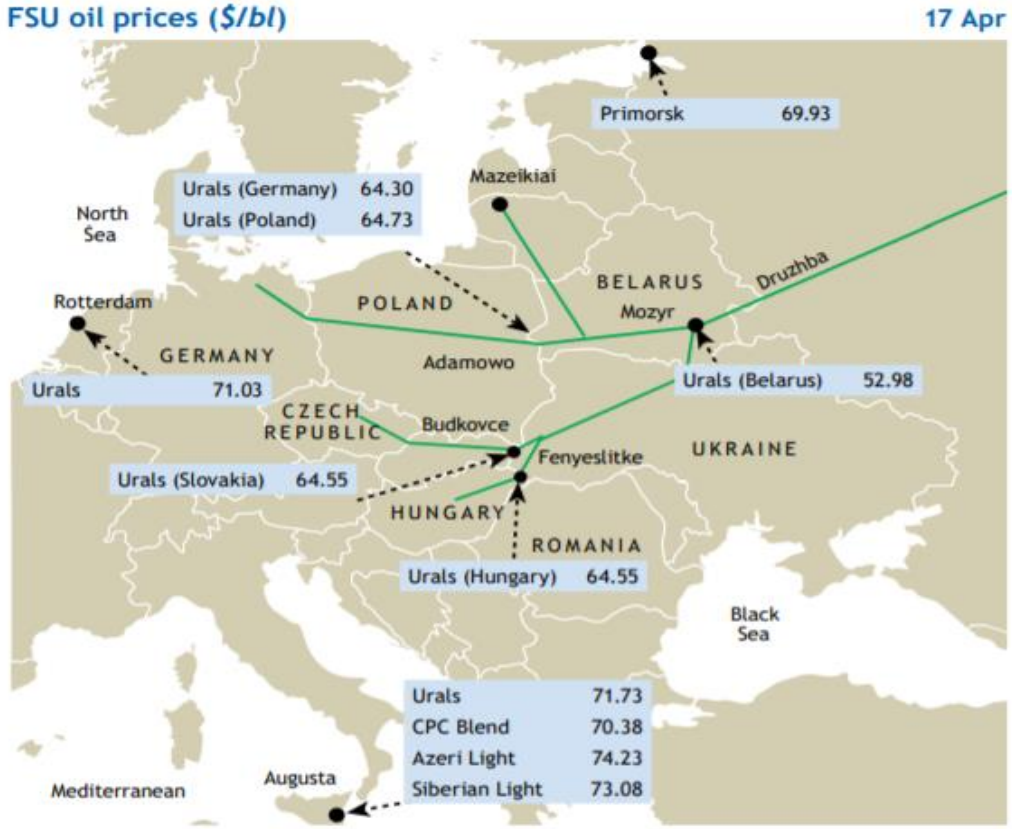
[13] 'Clean Russian oil has reached Belarus via key pipeline, Moscow says', Euronews, 29 April 2019, https://www.euronews.com/2019/04/29/clean-russian-oil-has-reached-belarus-via-key-pipeline-moscow-says.
[14] 'Net oil will not arrive at the Mozyr refinery not earlier than May 4 – Belneftekhim', BELTA (News of Belarus), 30 April 2019, https://www.belta.by/economics/view/na-mozyrskij-npz-chistaja-neft-postupit-ne-ranshe-4-maja-belneftehim-345936-2019/.
[15] 'Statement by the Ministry of Energy of Russia Regarding the Restoration of Quality Characteristics of Oil on the Druzhba Pipeline', Department of Energy, Russian Federation, 30 April 2019, https://minenergo.gov.ru/node/14705

The next stage of the plan is the clean-up of the other contaminated sections. Meanwhile, due to reduced export flows, the tank farms at Transneft's metering stations have filled. On 4 May, Transneft asked Russian oil companies to temporarily cut oil production by 10 per cent.[16]

The bottom line is that the supply interruption is a very serious one and crude deliveries to the refineries that use the Druzhba pipeline might be restricted to 40-60 percent of the pre-crisis flows for weeks. The problem here is not only about supply risk, but also about the price risk for the refineries dependent upon crude deliveries via Druzhba. Refineries usually have reserves of crude that can cover short-term supply interruptions, and the refineries on the Druzhba system have been tapping their reserves.

German and Polish refineries can be relatively easily supplied with crude from sea ports in the Baltic. But acquisition prices for Druzhba deliveries by the captive refineries have usually been significantly lower than prices for seaborne crude oil. Now, instead of paying prices based on 'Rotterdam minus' these refineries might be forced to pay prices based on 'Rotterdam plus' to cover the additional costs of delivery. (See Figure 4)

Figure 4: Oil prices at main European delivery points



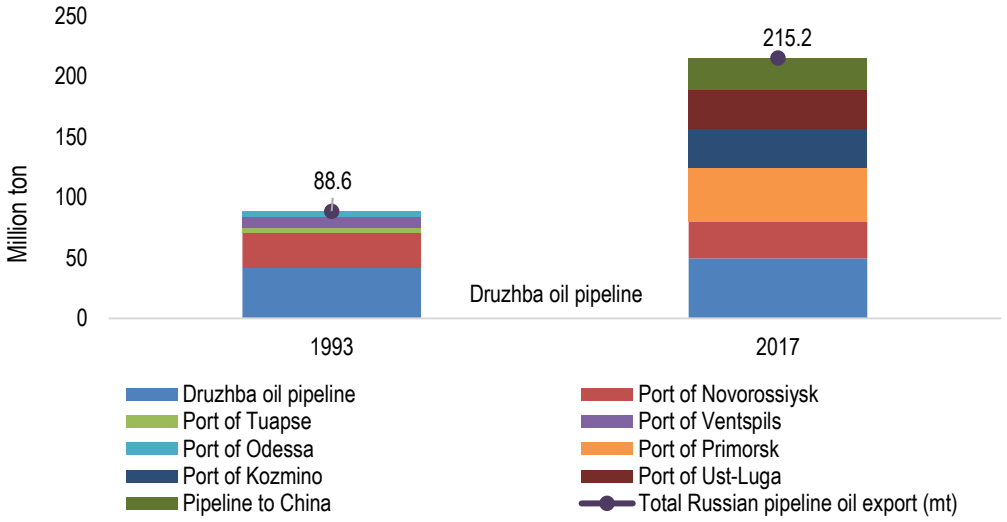
Source: Argus Media (www.argusmedia.com)

For Russia, crude exports via Druzhba are important, but not as critical as they used to be in the early 1990s when they accounted for almost half of Russia's oil exports to non-CIS countries. In 2017, Druzhba deliveries represented only 23 per cent of total oil exports to non-CIS countries (see Figure 5). Druzhba remains an indispensable supplier for Mozyr refinery in Belarus. The other Belorussian refinery, Naftan, can be (and has been) supplied by a different pipeline route. In a larger economic context, Russia and Belarus have been at loggerheads over the changing terms of oil trade. In the past

[16] 'Russia to cut oil output by 10 pct in next few days as exports suffer – sources', Reuters, 3 May 2019, https://www.reuters.com/article/russia-oil-output/russia-to-cut-oil-output-by-10-pct-in-next-few-days-as-exports-suffer-sources-idUSL5N22F5DB?fbclid=IwAR1sSp_Eln1jWxzSOI1ZXhIinyyotMWtHe_ZgUZG_Pe9IPcNcmy5FmHSHkY.

ten years Russia has built bypasses – BPS-1 and BPS-2 – that reduced transit dependence on Belarus. These new routes bring Russian crude to new ports on the Baltic Sea: Primorsk and Ust-Luga. These ports have become the major growth points for higher crude exports out of Russia. As part of the petroleum tax reform at home, Russia is gradually eliminating export taxes on oil and refined products.[17] This change is going to negatively affect the Belarusian economy by increasing its acquisition prices for crude oil and eliminating the arbitrage the country has been exploiting by buying crude at prices without Russian export tax (because Belarus is a member of a customs-free union with Russia and Kazakhstan) and then selling refined products at world prices.

Figure 5: Main export channels for Russian oil



Source: Author, data from Transneft

Premium for Urals versus discount for acidity

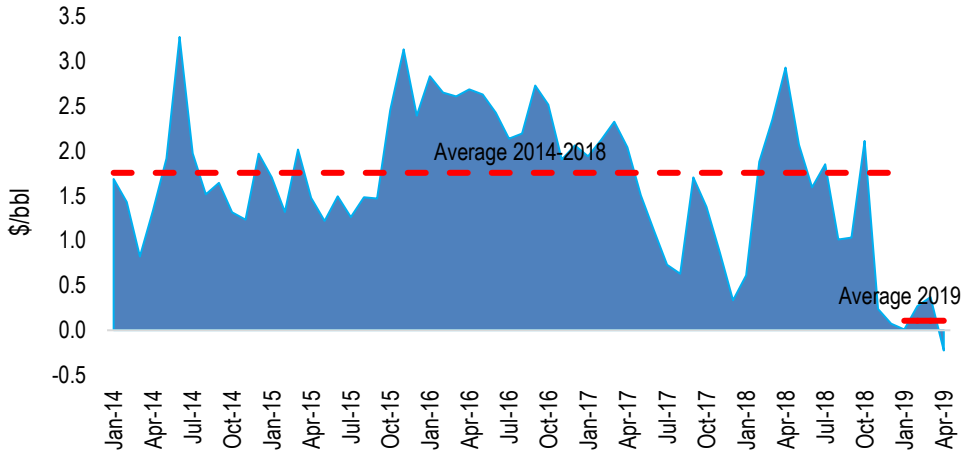
As a result of the contamination incident, Transneft is going to face growing criticism and is likely to incur significant direct and indirect costs. The only possible silver lining for Russia is that the shortage of medium-sour grades globally has already resulted in a price premium for Urals over Brent. In the past five years, the average Urals discount to dated Brent amounted to $1.76/bbl. But in 2019 this discount shrunk to a mere $0.1/bbl, while during April, Urals was offered at a premium to Brent (see Figure 6).

The costs of cleaning up the pipeline system and the costs of storing and marketing the chlorides-contaminated crude until it can be gradually diluted to the standard specifications might be significant. On the positive side, no apparent environmental damage has occurred. Damage to refinery equipment from possible corrosion has only been registered at the Mozyr plant in Belarus.

The obvious trade-off for the future is whether to dilute the contaminated crude to the required normal specs, or to dilute it just to the specs that would define it as acidic and then sell at a discount. Acidic crudes are a known phenomenon for the global refining industry. High concentrations of naphthenic acids in some crudes makes them quite corrosive for refineries. This is the case for some West African and Chinese crudes, for example Dona. Because they sell at a considerable discount due to their acidity, there are refiners who adapt the metallurgy of their refineries and use blending strategies to be able to refine as much acidic crude as possible.

[17] See Yermakov V., Henderson J., and Fattouh B. 'Russia's Heavy Fuel Oil Exports: challenges and changing rules abroad and at home', OIES Paper WPM 80, April 2019.

Figure 6: Brent–Urals price differential



Source: Author, data from Argus

A far as the volumes in Druzhba are concerned, they are likely to be brought up to normal quality once the flow of clean oil resumes. It will be just a matter of time. For the shipments from Ust-Luga that have already left the port and are now the liability of the trading companies, the above trade-off between the degrees of dilution is going to be a matter of logistical and commercial choice.

Conclusion

The Druzhba pipeline contamination with organic chlorides became the most serious interruption of oil supplies in the 55-year history of oil trade on this key route. While it appears to be a one-off event that has not brought about loss of life or affected the environment, the scale of the incident is such that it has had a profound impact on the whole value chain, from production facilities in Russia to refineries in Central Europe.

The scale of the incident is significant, but its impact upon security of supply in Europe is going to be limited to higher crude oil acquisition costs for the affected refineries supplied via alternative routes. Any temporary crude oil shortages could be filled from strategic reserves. There is no apparent risk of refined products shortages in Europe.

The exact costs for all the affected parties are yet to be determined. The same can be said about possible geopolitical fallout. Russia's reputation as a reliable supplier of energy to Europe has suffered, but whether it is going to make European refiners diversify away from Russian oil supplies via Druzhba in the future is an open question. Such a strategy may reduce supply risks for refineries in Central Europe that have historically depended upon this route. Its downside is higher price risk, as the acquisition prices for refineries would increase.

In Russia, regulatory changes regarding the rules of access to Transneft for oil producers are likely. Stricter regulation and more quality checks are going to have a disproportionately higher impact upon small producers, and any additional costs that Transneft might incur would be passed on to producers in the form of a higher regulated transportation tariff.