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Central Intelligence Agency

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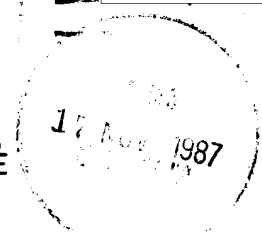
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Washington, D.C. 20505

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CIA-3-SR



DIRECTORATE OF INTELLIGENCE

October 1987

USSR: The Growing Petroleum Production Potential of the Pre-Caspian Basin

Summary

Sustaining a high level of oil production in the USSR has become increasingly difficult and costly as production from older oilfields declines progressively and the new, smaller fields prove to have markedly lower flow rates and shorter longevity. Articles appearing in Soviet media this year indicate, however, that a period of respite may lie ahead. The Soviet statements suggest that the Tengiz oilfield, located in the Pre-Caspian Basin, may provide a bonanza that would be a substantial factor in maintaining oil exports for hard currency. [redacted]

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From their ongoing reevaluation of the Tengiz field, Soviet geologists reportedly believe that they have identified the USSR's third giant oilfield capable of producing at the rate of at least 1 million barrels per day (b/d). The Tengiz field is located in the low-lying land around the northern rim of the Caspian Sea (see map). Known as the Pre-Caspian Depression, this area includes extensive salt-dome formations considered favorable for the accumulation of crude oil and natural gas. A recent Soviet press report asserts that the current oil potential of the Pre-Caspian Basin could be equal to the original potential of the Volga-Urals region, which has produced a cumulative total of over 40 billion barrels of oil since the 1930s. [redacted]

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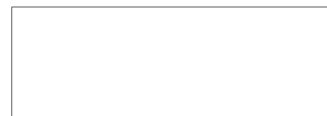
We believe that the Soviet comparison with the Volga-Urals region is overblown. Nevertheless, taking into account recent Soviet statements about the size and production potential of the

This memorandum was prepared by [redacted] Office of Soviet Analysis. Comment and questions are welcome and can be directed to Chief, Economic Performance Division [redacted]

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Tengiz field and considering the general geologic character of the region, we tentatively conclude that the combined oil and gas potential of the giant Pre-Caspian fields could be more than 28 billion barrels of crude-oil equivalent, sufficient to produce roughly 4 million b/d oil equivalent (about 50 percent oil and 50 percent gas). The prospective production of oil from these fields could range up to 2 million b/d after the turn of the century. That level of output would be equivalent to about one-sixth of the USSR's present production of oil and slightly greater than its present hard currency exports of oil. If a substantial increase in the region's production of oil can be realized through vigorous development over the next 5 to 10 years, earnings from Pre-Caspian oil could become a significant factor in maintaining the Soviets' ability to import agricultural commodities and industrial goods from the West. Gas production from the Pre-Caspian Basin will not only offset declining output from Orenburg and the Central Asian gasfields but also provide valuable byproducts such as sulfur and carbon dioxide. [REDACTED]

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Commercial exploitation in the Pre-Caspian Basin, however, will be difficult and expensive. Well-drilling, both in the exploration and development phases, is proving difficult because of problems associated with the great depth of producing formations, abnormally high pressures, and the presence of "sour" (toxic and corrosive) gas. Western technology and equipment are needed for many operations, and large purchases of such hardware are being made for the drilling and completion of wells and for processing output. However, both increased acquisition and better assimilation of Western technology are essential if exploration and development of this basin are to be accelerated. Many of the wells at Tengiz and Astrakhan', for example, are taking 1-1/2 to 2 years to drill and complete, compared with about 6 months for comparable wells in the United States. [REDACTED]

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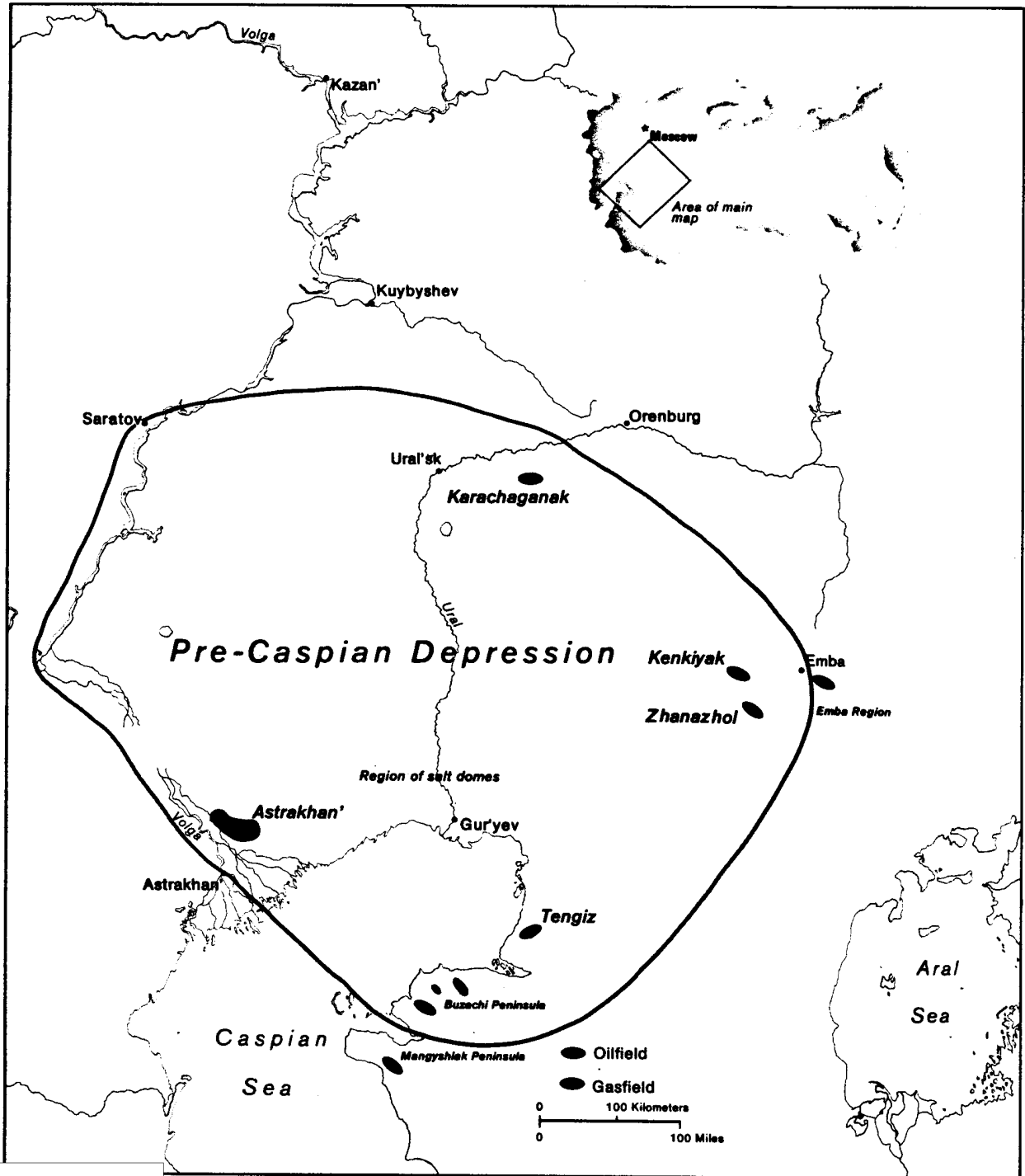
The Soviets have been seeking to arrange joint ventures for production of oilfield equipment based on Western technology. The Western technology and equipment of primary interest to the Soviets is for deep drilling, offshore oil production, and field processing for the extraction of natural gas liquids and removal of impurities from oil and gas streams prior to pipeline shipment. In addition to discussing joint-ventures, the Soviets have been indicating interest in Western technology through high-level attendance at international petroleum meetings and exhibitions. Although switching equipment procurement from direct purchase abroad to domestic manufacture by joint ventures would probably mean short-run delays, it may be seen by Moscow as preferable to increased hard currency outlays for importation of needed equipment. Obtaining more efficient equipment through joint ventures could enhance productivity in the oil and gas industries without large initial outlays of hard currency and, by sustaining the volume of oil available for export, could bolster hard currency earnings. [REDACTED]

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Soviet Pre-Caspian Basin



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The Basin's Potential

1. Soviet geologists have long believed that the Pre-Caspian Basin holds a large amount of oil and natural gas. A recent Soviet press report equates its current potential to the original potential of the Volga-Urals region, which has produced over 40 billion barrels of oil since the 1930s. However, the drilling of exploration wells necessary for a proper evaluation of the basin's potential has been hampered by the great depth (up to 6,500 meters) of producing formations and the related high geopressures and geotemperatures.

2. From their ongoing reevaluation of the Tengiz field, Soviet geologists reportedly believe that it is the third giant oilfield in the USSR capable of producing at the rate of 1 million barrels or more per day (b/d).¹ Soviet media state that the geologists have identified an oil-prone zone many hundreds of meters thick covering an area of several hundred square kilometers at Tengiz (which now incorporates the Korolevskoye and Ogayskoye fields). Consequently, they now believe that Tengiz belongs in the super-giant class of oilfields, and that its size may approach that of West Siberia's Samotlor. The Soviets reportedly anticipate that production will reach 140,000 b/d in 1990. Production at the rate of 1 million b/d would, however, be extremely difficult to achieve before the end of the century

¹ By Western definitions, only giant oilfields are capable of producing oil at this rate. A giant field has reserves of at least 500 million barrels of recoverable oil. [redacted]

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unless technology and equipment are acquired from the West. We currently believe--assuming the Soviet description of oil potential is valid--that the maximum crude oil production rate attainable at Tengiz in the mid-to-late 1990s is apt to be less than 500,000 b/d in the event that such acquisition does not occur. Full assessment of the Tengiz field is not expected before 1995 because of the large area and great depth of the highly fractured, porous-to-cavernous carbonate reservoir.

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3. On the basis of information currently available to us and consultation with oil-industry experts on the geology of the area, we tentatively conclude that the combined potential of the currently identified giant Pre-Caspian fields could be more than 28 billion barrels of crude-oil equivalent (table 1).² If reserves of this magnitude are proved and developed, they should be sufficient to support production of some 4 million b/d oil equivalent (about 50 percent oil and 50 percent gas). These discoveries, together with related data released by the Soviets, appear sufficient to justify the growing interest of Western oil executives in Pre-Caspian Basin oil and gas development projects. US exploration experts view the Pre-Caspian Basin and the Caspian Sea offshore areas as one of the world's best remaining oil and gas frontiers.

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² Further research is being undertaken by CIA's Office of Global Issues to provide an assessment of the Pre-Caspian Basin's potential.

2
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Table 1

USSR: Oil and Gas Potential of Pre-Caspian Basin

<u>Oilfields</u>		<u>Billion Barrels Oil</u>	
Total		17.2 ¹	
Tengiz		15.0	
Zhanazhol		1.5	
Kenkiak		0.2	
Buzachiy Peninsula		0.2	
Mangyshlak Peninsula (old)		0.2	
Emba Region (old)		0.1	

<u>Gas Fields</u>	² Gas (trillion cu.ft.)	+	<u>Natural Gas Liquids</u> (billion barrels)	=	<u>Billion Barrels Oil Equivalent</u>
Total	67.5		3.6		11.5
Astrakhan'	50.0		2.3 ⁴		7.2
Karachaganak	17.5		1.3		4.3

¹ The oil potential shown for Tengiz is highly speculative. It is estimated from Soviet media statements that the oilfield is hundreds of square kilometers in area, that the oil-prone zone may extend vertically some 1,500 meters, that the field may ultimately produce oil at the rate of 1 million b/d, and that the size of reserves approaches those originally at Samotlor (which may have been 15-20 billion barrels).

² Natural gas reserves are converted into oil equivalent at the rate of 5,604 cu ft of gas (5.8 million Btu) per barrel of oil. At Astrakhan' the oil equivalent value was reduced by 45 percent to eliminate the hydrogen sulfide and carbon dioxide. Natural gas liquids (NGL) are defined here to include hydrocarbons such as ethane, propane, butanes, pentanes, etc., that exist in a gaseous state in the reservoir. In the West, these liquids are usually converted at the rate of 10 barrels per metric ton of NGL. However, for our calculations we use a more conservative rate of 7.3 barrels per ton to calculate oil equivalent. This yields figures which more closely match published Soviet data.

³ Estimated

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⁴ indicates Karachaganak is much richer in natural gas liquids than Astrakhan'. We have conservatively estimated 1.3 billion barrels of NGL and condensate based on the planned output of 8 million tons annually over a 20 year period.

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The Importance of Pre-Caspian Basin Petroleum

4. Moscow is pressing ahead with ambitious plans for the development of Pre-Caspian resources. If Soviet assertions about the size and productive potential of the Tengiz oilfield are generally valid, the basin's prospective production of oil from presently identified fields could range up to 2 million b/d after the turn of the century. That level of output would be equivalent to about one-sixth of the USSR's present production of oil and slightly greater than its present hard currency exports of oil. If this prospective output can be realized through vigorous development over the next decade, it could become a significant factor in maintaining Soviet ability to import agricultural commodities and industrial goods from the West. Gas production from the Pre-Caspian Basin will not only offset declining output from Orenburg and the Central Asian gasfields but also provide valuable byproducts such as sulfur and carbon dioxide.

5. Production is declining in 24 of the USSR's 28 oil-producing regions; and, though production is still rising slowly in West Siberia, many of the giant oilfields there--including Samotlor, Fedorovo, and Mamontovo--are in decline. The Soviets are mounting a massive effort to exploit additional producing horizons in existing fields and to tap peripheral fields. But, because the new wells are generally characterized by relatively low flows and short productive lives, well-drilling requirements are doubling every five years--putting a premium on deposits of

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the size now claimed by the Soviets for the Pre-Caspian Basin.

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6. Western petroleum geologists have assigned a high oil and gas potential to the Pre-Caspian Basin, a salt basin similar in some respects to Persian Gulf oilfields and to US and Mexican producing areas on the Gulf of Mexico. The Soviets have mapped 400 to 1,000 salt-dome structures in the basin, many of which could be highly promising traps for the accumulation of oil and gas. Until the past decade, however, only small deposits were exploited. At the end of the last century, oil production commenced in the Emba region, about 400 kilometers northeast of the Caspian Sea. Subsequently, about 30 small oilfields with a combined output of less than 50,000 b/d were developed above or on the flanks of numerous salt domes in the Emba and Kenkiak areas.

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7. Hampered by a lack of technology and equipment appropriate for deep drilling into highly pressured formations, Soviet exploration of the Pre-Caspian Basin proceeded slowly until Western-type deep drilling rigs were obtained (many from Romania) around 1970. The five best major oil and gas discoveries made in the region during the late 1970s--Tengiz, Astrakhan', Karachaganak, Kenkiak, and Zhanazhol--were in deeper sediments below a thick salt layer along the rim of the Pre-Caspian Basin. In addition, a cluster of shallow heavy-oil deposits was discovered on the Buzachiy Peninsula. Deposits of high-viscosity heavy oil, however, usually realize lower recovery

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rates and are more difficult to extract than deposits of lighter oil; consequently, they are of less economic value. Heavy oil, moreover, is usually contaminated with vanadium and other trace metals and thus requires special treatment for their removal prior to refining. [redacted]

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Exploitation Technically Challenging

8. The Soviets are technically incapable of duplicating the pace of Mexican development of roughly comparable petroleum deposits in the 1970s. They lack the vital deep-drilling technology, modern exploration theory, and geophysical instrumentation for more rapid evaluation of the Pre-Caspian Basin, as well as domestic capability to manufacture suitable producing equipment for proper exploitation of the deposits found. Soviet progress thus far in sour oil and gas development could not have been achieved if only domestic equipment had been used. Moscow has been spending about \$100 million a year for Western drilling and well-completion equipment. They have also spent some \$800 million to obtain four Western-manufactured gas processing plants for the Astrakhan' and Karachaganak sour gas projects. As the region is developed further, additional gas-plant purchases from the West are likely. [redacted]

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9. The difficulties and delays affecting the pace of exploration and development in the Pre-Caspian Basin are primarily associated with the great depth of producing formations, the abnormally high pressures and temperatures

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encountered, and the presence of sour (toxic) gas. The sour gas reservoirs of the Pre-Caspian Basin have very high concentrations of hydrogen sulfide and carbon dioxide (up to 24 percent hydrogen sulfide and over 20 percent carbon dioxide). Both are very corrosive and can destroy standard downhole producing equipment in a few days. However, special high-chrome stainless steel equipment can operate for 15 years without problems. It is important that the internal working surfaces of all equipment exposed to hydrogen sulfide be fabricated from this material.

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10. The inability of the Soviets to cope effectively with this severe operating environment has led to drilling disasters (blow-outs), toxic-gas leaks, explosions, and loss of life. In 1985, a Tengiz well blew out just as drillers were approaching the producing horizon. The spray of oil and gas from the well caught fire and burned with a 200-meter high flare for over a year. It was finally extinguished after US experts were called in. Damage was reported to livestock, wildlife, and the environment within a 30-mile radius of the well. Problems with collapsed well casings and tubing leaks have been reported at Astrakhan', and pipeline leaks there have released toxic gases and caused fatalities.

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11. Despite the Pre-Caspian Basin's long (though thus far relatively insignificant) oil-producing history, exploration of its full potential has never progressed beyond the early

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stages. The geology above and below the thick salt bed appears to be very complex, and exploration and production technology and equipment of the sort available from Western firms is badly needed. [REDACTED]

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Meeting Needs for Western Technology

12. Since awarding contracts in late 1986 to the Canadian firm Partec-Lavallin for procurement of technology and equipment to be used in development of the Astrakhan' and Tengiz sour gas and oil projects, the Soviets have been seeking to arrange joint ventures that would involve domestic production of oilfield equipment based on Western technology. This would enable the Soviets to upgrade oil and gas field operations without large outlays of hard currency. Moscow's need to sustain oil production and exports to bolster hard currency earnings is undoubtedly a strong motivating factor behind its current overtures. [REDACTED]

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13. Moscow's longer-term interest in using joint ventures as a means to develop exports of Soviet-made products runs counter to Western firms' interest in avoiding a glut in the world petroleum equipment market. Nevertheless, joint ventures with the Soviets might be attractive to Western firms if:

- Technology or equipment to be supplied through the joint ventures would not otherwise be purchased by the USSR because of shortages of hard currency and adherence to a policy of reliance on domestic suppliers when possible.

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- All of the equipment manufactured by the joint venture would be used within the Soviet oil and gas industries, where demand for equipment has traditionally exceeded supply by a significant margin.
- The Western participants in the joint venture would be given sufficient cost and quality control over production operations to assure them a profit.
- Transfer of profits to the Western participant would be in hard currency (or, perhaps, in oil).

It is problematic whether Moscow would agree to a joint venture arrangement on these terms. The joint venture concept as currently described by the Soviets is vague in some respects; basically it involves Western investment of capital and technology for the production of oilfield equipment in the USSR. Production-sharing and revenue-sharing from the export sales of the oil, gas, or equipment produced are being discussed, but only general guidelines have been issued covering issues such as compensation, accounting, taxation, management, labor, and equity. Where there is some urgency, the Soviets have shown willingness to negotiate on these issues. They have discussed more than 200 joint ventures with Western firms, but only a handful of such deals have been concluded. In some cases the negotiations have led to traditional procurement contracts.

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14. Late last year, the Soviets identified three major types of domestic oilfield technology and equipment that need

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immediate improvement: deep drilling (onshore and offshore), offshore oil production, and field processing for the extraction of natural gas liquids and removal of impurities from oil and gas streams prior to pipeline shipment. A high-level Soviet delegation attending the World Petroleum Congress in Houston in April 1987 indicated that \$1 billion had been earmarked for the acquisition of Western drilling and producing equipment and related technology. The same group paid a visit to the offshore petroleum technology conference at Houston's Astrodome and expressed great interest in deep-drilling rig assemblies for offshore and onshore service, online systems for monitoring drilling operations, Christmas tree wellhead installations, and seamless tubular steel products (casing, tubing, drill pipe, and drill collars). Most of these items are needed for both onshore and offshore operations. The Soviets also have hosted numerous Western petroleum equipment manufacturing delegations from the US, Finland, Japan, Sweden, Norway, Canada, the United Kingdom, Italy, France, and West Germany. [REDACTED]

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15. In the short run, switching procurement of high-quality petroleum equipment from direct purchase abroad to domestic manufacture by joint ventures could result in delays to Soviet petroleum exploration and development plans. Moscow's attempt to

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rely heavily on domestically supplied materials and equipment thus far has not produced satisfactory results in the Pre-Caspian Basin. Numerous equipment failures and at least three well blowouts have occurred. Despite these difficulties, Moscow has decided to rely heavily on domestically produced equipment. Unless joint ventures or other arrangements with Western firms materialize in a way that will substantially accelerate and greatly advance the level of technology embodied in such equipment, planned development in the Pre-Caspian Basin will continue to suffer long delays.

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