

SEQUENCE OF EVENTS: ARAMCO AND GENSCAPE

9/14

- » Aramco announces **5.7 mmbpd offline** (Abqaiq, Ghawar, Khurais...Shaybah unclear)
- » We provided clients with affected field average production for Aug/Sept (ties to Aramco's 5.7 mmbpd), and clarified that Khurais was ramping after partial maintenance prior to the attacks
- » We determine no more than **10 desulfurization towers** hit

9/15

- » We alert clients that 1 mmbpd - 3 mmbpd of the 5.7 mmbpd was clearly offline or engaged in shut-in procedures
- » Notably, we state that **part of Khurais was operational (confirmed on 9/17 by Aramco, "...1/3 of Khurais was back online within 24 hours of the attacks")**
- » We caution clients that sour crude may be getting stored while processing capacity is offline (confirmed 10 days later by "sources" in FT / WSJ articles)
- » **Energy Intelligence Group ("EIG") reports Saudi oil production was ~10.5 mmbpd just prior to the attack. Our detections were ~10.3 mmbpd just prior to the attack (we informed clients that Aramco blends up to 200 kbpd of condensate into crude streams)**
- » EIG reports that **Aramco is close to restoring 40%** (2 mmbpd from Abqaiq and at least 300 kbpd from Khurais, which is **consistent with our detections in re outages**)
- » We provide clients with production by field for affected and unaffected fields; quantified spare capacity by field and grade
- » We clarify that Shaybah was essentially uninterrupted

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- » We detect only ~2.4 mmbpd to ~2.8 mmbpd (~52% shut-in...**confirmed by Aramco on 9/17**) of production losses at affected fields (each field level quantified)
- » We detect ~300 kbpd in additional production at unaffected on/offshore fields
- » We provide **Abqaiq processing logistics clarity**; clarify that 13 towers and 2 - 4 spheroids appear relatively undamaged...provide mathematical framework to quantify processing capacity offline...explain why spheroids are the bottleneck to Abqaiq capacity and show that up to 3.2 mmbpd of spheroid capacity is likely functional, but that 7 are needed to return to 4.5 mmbpd of processing

9/17

- » **We detect ~50%** of affected production continuing to flow in the morning (**confirmed by Aramco several hours later**); provide breakdown by field
- » Aramco officially discloses in the afternoon that **"50%+ of affected production has been returned during the past couple of days"**
- » Aramco states that Khurais was partially restarted within 24 hours of the attack, which is **consistent with our detections**
- » We continue to reiterate the difference between sour wellhead production and post-processed sweet crude
- » Based on details from the Aramco press conference and continued independent research, **we provided additional clarity on which fields were bottlenecked by damaged infrastructure and to what degree**

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- » **We detect 60% of affected production returned and Bloomberg reports a call between MBS and South Korea quoting that ~67% of production was restored** and that the Kingdom expected a full recovery in 10 days
- » We add to earlier research on Saudi oil infrastructure, **clearing up common misconceptions about bottlenecks and production recovery times**
- » English translation of the 9/17 press conference becomes available, confirming our earlier research that a good portion of the original 5.7 mmbpd of impacted production was not bottlenecked by the Abqaiq facility. Based on the press conference, 1.2 mmbpd was not being processed at Abqaiq pre-attack, which is consistent with our earlier assertions that Khurais processed its own crude. Moreover, that only 5.7 mmbpd was affected implies Shaybah was also not completely constrained by processing at Abqaiq, which is consistent with our research

Trafigura Chief Economist, Saad Rahim:

"During a time of unprecedented uncertainty, Genscape's High-Frequency service was an absolutely invaluable tool to help us cut through the noise to see what was really happening. Both the information and detailed analysis allowed us to be a step ahead of the game."

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» We detect ~60% of affected production flowing and continue to provide customers with field-level production data on affected and non-affected fields

9/20

» Further reports of repair progress emerge when Argus reports that Abqaiq processing capacity rose to 2.5 mmbpd from 2.0 mmbpd, which equates to ~60% of affected production returning... **providing yet more 3rd party evidence that our detections of 60% back online were accurate**

9/21

» We continue to detect that ~60% of affected production is flowing, but we also detect another 200kbpd in additional production at unaffected on/offshore fields

» We release further research on Shaybah and Khurais, **adding near-conclusive evidence of our earlier assertions that the two fields were not constrained by Abqaiq**

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» We continue to detect ~60% of affected production back online

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» Anonymously sourced tweets and other media reports suggest that roughly ~75% of affected production is back online, but we **notify clients that this amount of recovery is unlikely given our detections and we maintain that ~60% of affected production has returned**

» We alert clients that Ghawar production may increase further based on improving signals

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» We detect increasing and normalizing signals at Ghawar, which **equates to 72% of affected Saudi production being restored**

9/25

» We detect continued improvement at Ghawar resulting in 75% of affected Saudi production being restored

» Our detected production and infrastructure research is verified by "sources" in an FT article – notably, that **crude production was "slightly above 8m b/d as of the start of this week"** and also that Shaybah continued to produce at roughly 1 mmbpd (its capacity) since the attacks (i.e., **Shaybah is not constrained by Abqaiq**)

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» We detect normal operations at Ghawar, increasing the restoration of affected production to 87%

» **Our detections from 9/25 indicate that Saudi crude oil production is ~10.078 mmbpd**

» **5 days later on 9/30, Aramco Trading CEO Ibrahim al-Buaninain stated that Aramco was able to reach 9.9 mmbpd on 9/25 and a "little bit" higher than that thereafter**

9/27

» We continue to detect ~87% of affected production is back online

9/28

» We detect abnormal activity at Ghawar, lowering our detected production for that field and the country as a whole, indicating that **~82% of affected production is back online**

» WSJ articles indicate that the market is beginning to follow the differences between wellhead sour crude production and post-processed sweet crude that is ready for sale, which we discussed since 9/15 (see info on 9/15 tab)

» We have been very careful to explain the difference between sour wellhead and processed sweet crude to clients throughout the course of these updates from the beginning

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» Activity returns to **normal at Ghawar**, increasing our detection for that field and the country as a whole, indicating that ~87% of affected production is back online

9/30

» We continue to detect that ~87% of affected production is back online

» **Aramco Trading CEO Ibrahim al-Buaninain states that Aramco was able to reach 9.9 mmbpd on 9/25 and a "little bit" higher than that thereafter, confirming our detections from 9/25 onwards**

10/10

OPEC released its Monthly Oil Market Report ("MOMR"), which disclosed September oil production levels for members. Saudi Direct Communication reported 9,129 kbpd of production in September vs. the "Secondary Sources" at 8,564 kbpd. Our HFOPM detected ~9,279 kbpd. Our slight overage vs. Saudi Direct Communication is wholly due to the timing of our signal detections vs. the attack itself on the first day.