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Summer Field Detection Trials in Singapore

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Authored by:

Róbert HROMADA

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1. INTRODUCTION

The **Falcon 4G** is a long-range active stand-off **chemical detector** that can detect, identify and measure chemical warfare agents (**CWA**) and toxic industrial chemicals (**TIC**) using two independent eye-safe pulsed tunable CO_2 lasers. Its patented laser technology is undetectable by laser warning devices, making it an effective tool for **military, homeland security and industrial applications**.

2. TRIAL CONDITIONS

Date	July 1, 2025, 12:00 AM – 3:00 PM
Place	PUB Lower Seletar Tidal Gates, Singapore
Weather	Sunny
Wind speed	2 m/s S – 4 m/s SW
Humidity	70 – 85 %
Temperature	33 – 38 °C
Simulants[1]	SF_6
Demonstration	1st release. 5,0 kg SF_6 – 5 min
	2nd release. 5,0 kg SF_6 – 5 min
	3rd release. 6,6 kg SF_6 – 3 min

3. METHODOLOGY

The demonstration ("**demo**") took place in PUB Lower Seletar Tidal Gates, Singapore. Release point of SF_6 was situated on the opposite shore of the bay. The length of the detection path was approximately 1300 m (Fig. 1)

Longe-range active stand-off chemical detector Falcon 4G with MTU P/T platform was set-up in under 10 minutes. The detector was mounted on a tripod and positioned on the first floor of the small tower, where other sensors were deployed as well. Falcon 4G was operated remotely via a ruggedized Getac laptop located at the ground level. A 35-meter LAN cable was used to connect the Falcon 4G to the laptop.

[1] Please refer to the last page of the report for detailed information about the simulants.

The Singapore team released the SF_6 simulant at the designated release point (Fig. 2). Three releases were conducted.

- 1st Release 5,0 kg SF_6 – 5 min
- 2nd Release 5,0 kg SF_6 – 5 min
- 3rd Release 6,6 kg SF_6 – 3 min

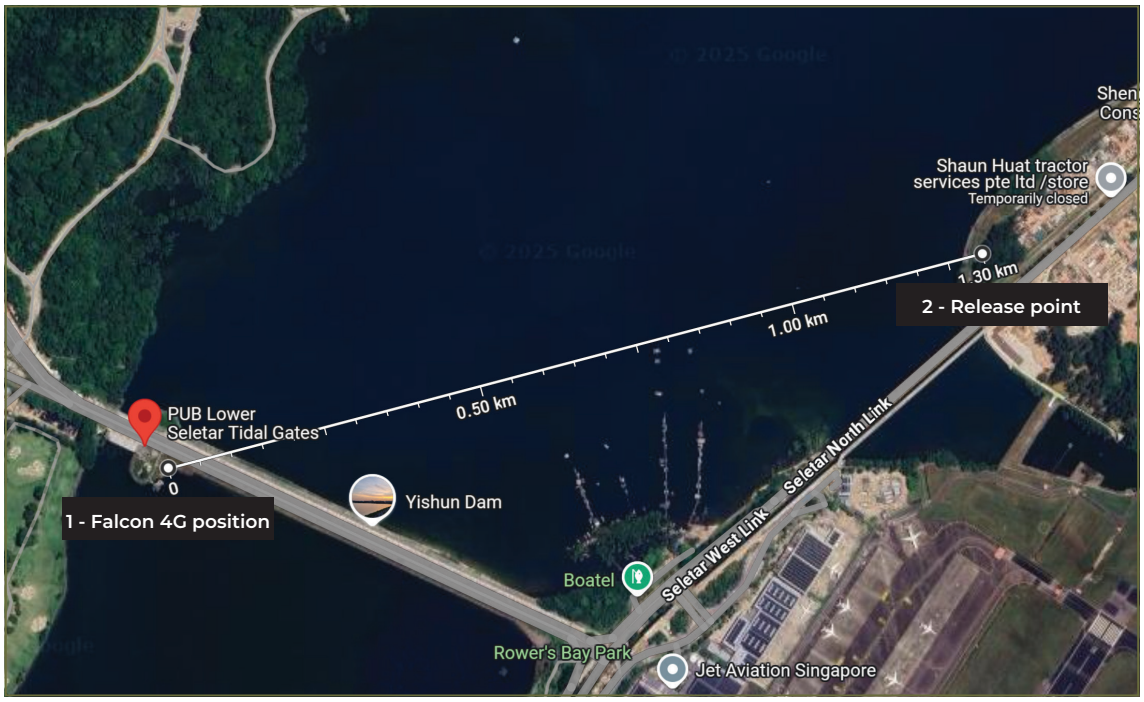


Fig. 1 Falcon 4G Demo Site in Singapore

Fig. 2 Release Point - Position Change

The position changed with each release, as illustrated in Fig. 2. The red box serves as a reference point for orientation.

Fig. 3 Position of the Falcon 4G

Fig. 4 Falcon 4G on the tower

Communication between Falcon 4G and GETAC PC was established through 35 m LAN cable.

4. DEMONSTRATION

The map (Fig. 1) shows the **distance** between **gas release site** and the **Falcon 4G detector** as **1300 m which was the maximum distance available at the test site.** During the actual measurement, the range varied from 1298 m to 1306 m.

4.1 1st RELEASE

At 14:30 SGT (GMT+8) personal from DSTO Singapore started with releasing SF_6 gas from gas cylinder at the position marked on the Fig. 2 (approx. 48N 374229 157855). The release lasted 5 minutes, during which 5 kg of SF_6 was used. The operator initiated the measurement immediately after the release begun.

The first positive detection of SF_6 occurred at 14:30:21, which corresponds to 21 seconds after the release began (Fig. 5 and Fig. 6).

Fig. 5 Release Point – 1st Release

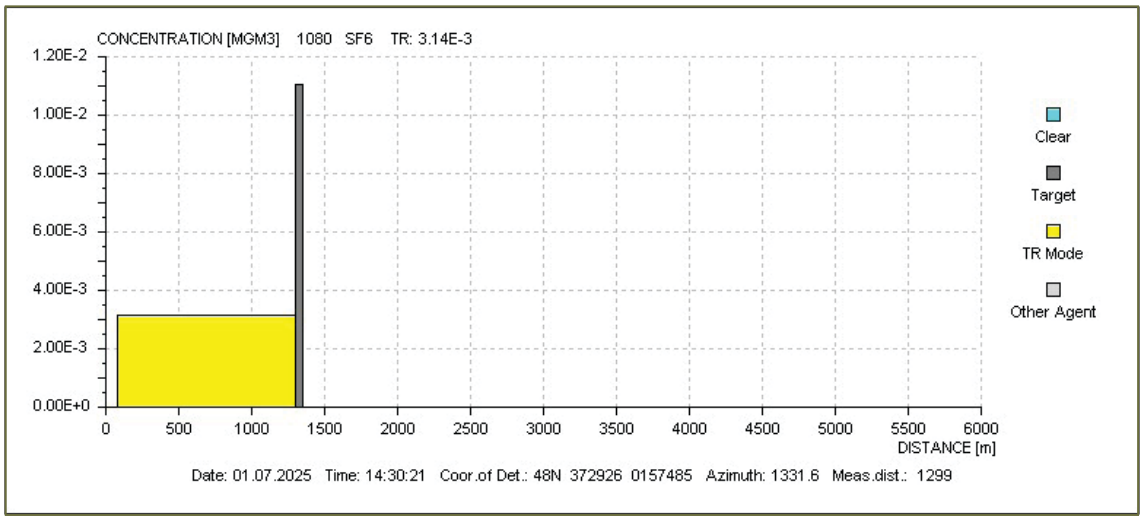


Fig. 6 Detection Result – 1st Release

Detection of SF_6 continued over several measurements, which confirmed its presence and showed increasing concentration trend. Shortly thereafter, the gas dispersed into the environment, resulting in decline in concentration. (Fig. 6)

Table 1 Detection No. 1 - 5 kg SF_6 in 5 min

Time	Concentration x10-3 mg/m³	Distance
14:30:06	0	1301
14:30:14	0	1303
14:30:21	3,1	1299
14:30:54	3,69	1301
14:31:22	3,64	1301
14:31:49	4,03	1298
14:32:41	3,55	1300
14:34:15	2,7	1302

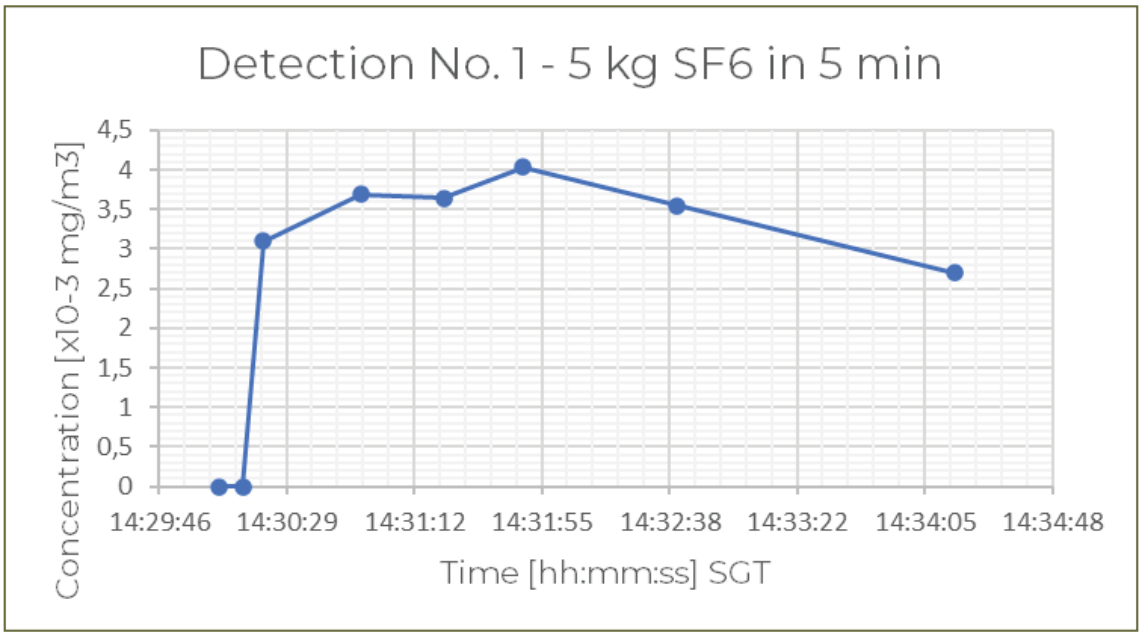


Fig. 7 Detection No. 1 - 5 kg SF_6 in 5 min

Conclusion of the 1st release

Despite relatively high temperature and humidity the Falcon 4G successfully detected the chemical within seconds of the release. **The 1st release of the test was successful** and confirmed the Falcon 4G's reliable performance even in challenging weather conditions.

4.2 2nd RELEASE

The release started at 14:53 SGT (GMT +8). Setup was exactly the same as 1st release. Personal from DSTO Singapore started with releasing SF_6 gas from gas cylinder at the position marked on the Fig. 2 (approx. 48N 374229 157855). They slightly move few meters to the left side (from Falcon 4G view). Second release took 5 minutes and 5 kg of SF_6 was used. Immediately after release started operator run the measurement with goal to find the new release point.

The first positive detection of the SF_6 was 14:53:41 (Fig. 8 and Fig. 9).

Fig. 8 Release Point – 2nd Release

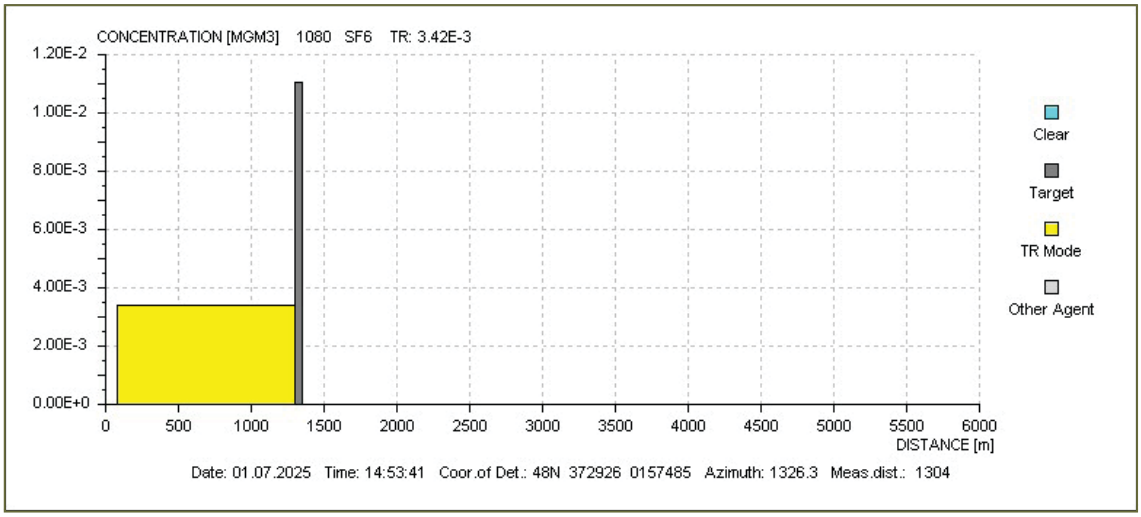


Fig. 9 Detection result – 2nd Release

Same as during 1st release, the detection of SF_6 gas was repeatedly confirmed through several measurement attempts. presence of the SF_6 gas and showed increasing concentration trend. During the release phase the concentration of SF_6 remained almost at the same level (see Table 2 and Fig. 10).

Table 2 Detection No. 2 - 5 kg SF_6 in 5 min

Time	Concentration	Distance
14:53:41	3,42	1304
14:55:35	3,69	1303
14:55:57	3,11	1302
14:56:27	3,36	1305
14:56:35	3,09	1303
14:56:52	2,94	1303
14:58:01	3,34	1304
14:59:32	3,21	1306

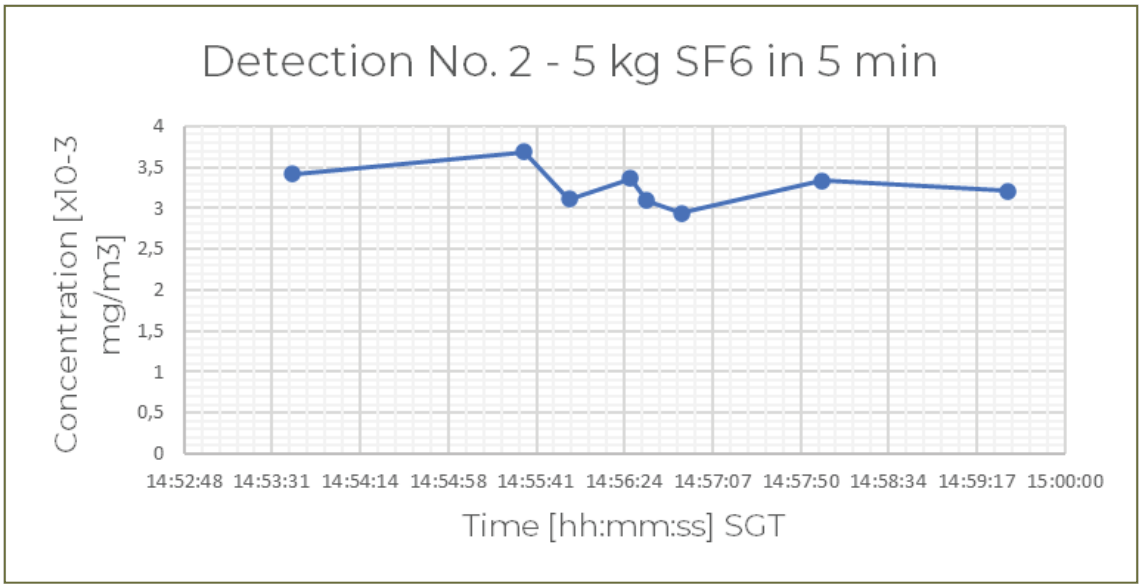


Fig. 10 Detection No. 2 - 5 kg SF_6 in 5 min

Conclusion of the 2nd release

The 2nd release was successful and further confirmed Falcon 4G's reliable performance, demonstrating rapid response and ability to promptly find contaminated area.

4.3 3rd RELEASE

Third release started at 15:20 SGT (GMT +8). The setup was slightly modified compared to the first two runs. Personnel from DSTO Singapore started releasing SF_6 gas from cylinder at the location indicated on the Fig. 1 (approximately 48N 374229 157855). They then slightly move back a few meters to the right side, relative to the Falcon 4G's viewpoint. The third release lasted only 3 minutes, using 6.6 kg of SF_6. Immediately afterward, the operator began measurements with the goal of locating the new release point.

First positive detection of the SF_6 was 15:20:26 (Fig. 11 and Fig. 12).

Fig. 11 Release Point – 3rd Release

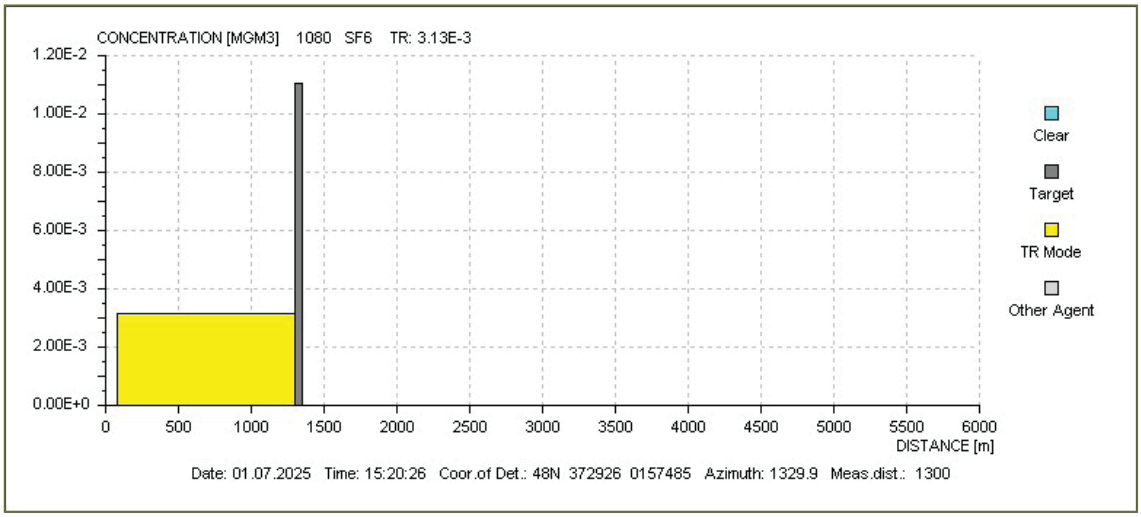


Fig. 12 Detection Result – 3rd Release

Despite the fact that 3rd release was conducted overa shorter period than the previous two and involved a larger amount of SF_6 gas, similar result were observed. The Falcon 4G detector registered a positive detection within seconds after the release, and the concentration showed only slight variations during the measurement (Fig. 12 and Fig. 13).

Table 3 Detection No. 3 - 6.6 kg SF_6 in 3 min

Time	Concentration	Distance
15:20:26	3,13	1300
15:21:06	3,62	1301
15:22:15	2,44	1303
15:22:33	2,4	1303
15:22:52	2,73	1303
15:23:10	2,82	1303

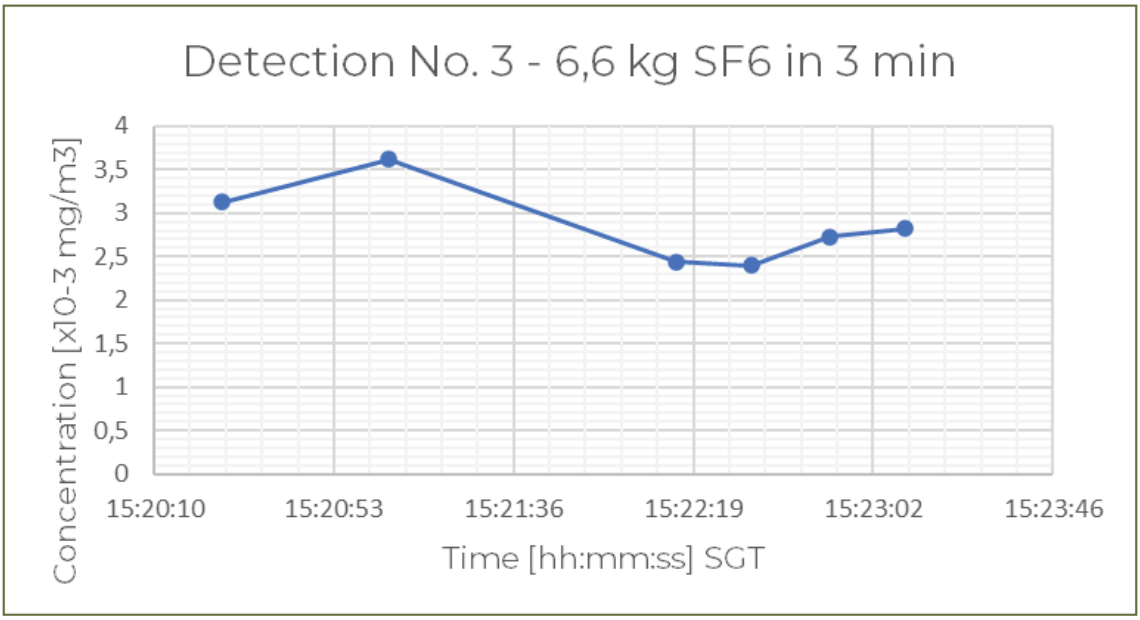


Fig. 13 Detection No. 3 - 6.6 kg SF_6 in 3 min

Conclusion of the 3rd release

The 3rd release of the test was successful and further confirmed Falcon 4G's reliable performance, demonstrating rapid response and ability to promptly find contaminated area.

5. RESULTS

The Falcon 4G detector was tested for its ability to detect SF_6 gas releases at a distance of approximately 1300 meters in Singapore. The demonstration included three separate gas releases, each from slightly different positions. In each trial, the detector successfully identified the presence of SF_6 within seconds of the release.

Concentration measurements showed a rapid increase after release, followed by a gradual decrease as the gas dispersed.

The system consistently detected the gas, even when the release point was shifted. Detection was reliable despite challenging weather conditions such as high

temperature and humidity. The detector's response was quick and allowed for fast identification of contaminated areas. Results were consistent across different release durations and gas quantities.

Communication between the detector and control PC was stable and effective throughout the tests. Overall, the Falcon 4G demonstrated robust and reliable performance for long-range chemical detection in field conditions.

6. CONCLUSION

The Falcon 4G detector demonstrated:

1. Rapid, reliable detection of SF_6 gas at long range under varying conditions.

2. Positive detection occurred within seconds of gas release in all trials.

3. The active stand-off detector Falcon 4G effectively identified the contaminated area even when the release point was changed between tests.

4. Detection remained consistent despite changes in release duration, gas quantity, and environmental factors (temperature & humidity).

5. This demonstration confirms the Falcon 4G's suitability for rapid, remote chemical detection in field scenarios.

Demo attendees commented that the **Falcon 4G offers "excellent detection speed and an impressive detection threshold."** They described it as "**a versatile active stand-off detector, ideal for early warning and monitoring of chemical clouds."**

Users also appreciated that the long battery life and the option to power the detector from the electric grid make it highly practical in the field. Furthermore, they noted that challenging weather conditions—such as high humidity and temperature—did not affect the detector's performance.

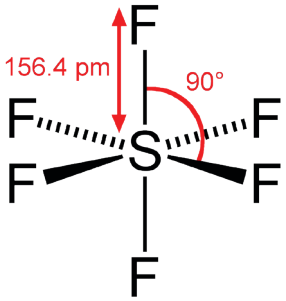
FALCON 4G

Long-Range Active Stand-off Chemical Detector

The 4th generation active stand-off detector is based on **eye-safe** and **undetectable laser technology**.

- **Detection**
- **Identification**
- **Quantification**
- **Up to 6 km**
- **Best sensitivity on the market**
- No calibration needed
- Distance to the cloud without triangulation
- Refractors not required
- No need to scan background

SIMULANTS



SULPHUR HEXAFLUORIDE

SF6
CAS: 59109-69-2
Molecular weight: 146.06 g/mol)
Relative vapor density (air = 1): 5

Sulfur hexafluoride is an inorganic compound with the formula SF6. It is a colorless, odorless, non-flammable, and non-toxic gas. SF6 has an octahedral geometry, consisting of six fluorine atoms attached to a central sulfur atom. It is a hypervalent molecule.

Sulfur hexafluoride (SF6) is the electric power industry's preferred gas for electrical insulation and arc quenching/current interruption equipment used in the transmission and distribution of electrical energy.

Source: https://pubchem.ncbi.nlm.nih.gov.

SEC Technologies, s.r.o.

1. mája 4269
031 01 Liptovský Mikuláš
Slovakia

+421 905 327 966

martin.valovsky@sec-technologies.com
michal.simko@sec-technologies.com

www.sec-technologies.com