# Waterinjectie Nijensleek

# Jaarrapportage 2015

VERMILION
ENERGY

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## *Introductie*

Op 09 februari 2010 heeft het Ministerie van Economische Zaken toestemming gegeven om formatie water in de diepe ondergrond te injecteren op locatie Nijensleek (NSL) aan de Bosschasteeg te Nijensleek.

In de voorschriften behorende bij deze beschikking is opgenomen dat de meet en registratie verplichtingen jaarlijks worden geëvalueerd en in de vorm van een jaarrapportage worden ingediend. Gelieve bij deze aan te treffen de jaarrapportage voor 2015.

## *Inhoudsopgave*

## *Samenvatting*

Gedurende het jaar 2015 is formatiewater van de velden Brakel, Eernewoude, Langezwaag, Middenmeer en Slootdorp in de put Nijensleek-01 (NSL-01) geïnjecteerd.

De maximaal te injecteren hoeveelheid productiewater volgens de beschikking bedraagt 350 m3/dag met een maximaal totaal van 240,000 m3. Het totale geïnjecteerde water volume in 2015 is 12.434 $m^3$.

In totaal is er **13.314** $m^3$ (2011) + **3.654** $m^3$ (2012) + **2.006** $m^3$ (2013) + **7.640** $m^3$ (2014) + **12.434** $m^3$ (2015) = **39.048** $m^3$ geïnjecteerd in Nijensleek.

Samen met het productie water wordt er 140 ml/uur Cortron CK-956-G corrosie remmer geïnjecteerd. Daarnaast worden er geen andere additieven geïnjecteerd.

## *Afwijkingen in injectiedrukken*

De injectie druk wordt regelmatig genoteerd tijdens routine rondes.

Gedurende het jaar 2015 is de put druk eigenlijk altijd 0 bar.

| Nijensleek-01 | |
|---|---|
| Datum | WHP (Bar) |
| 09/01/2015 | 0 |
| 16/01/2015 | 0 |
| 21/01/2015 | 1 |
| 29/01/2015 | 0 |
| 19/02/2015 | 0 |
| 22/03/2015 | 0 |
| 05/04/2015 | 0 |
| 26/04/2015 | 0 |
| 23/05/2015 | 0 |
| 30/05/2015 | 0 |
| 07/06/2015 | 0 |
| 21/09/2015 | 0 |
| 13/10/2015 | 0 |
| 30/10/2015 | 0 |
| 09/11/2015 | 0.9 |
| 13/11/2015 | 0 |
| 29/11/2015 | 0 |

## *Afwijkingen in annulaire drukken*

De annulaire druk wordt regelmatig genoteerd tijdens routine rondes.

De onderstaande tabel geeft een overzicht van de annulaire drukken over het jaar 2015.

| Nijensleek-01 | | |
|---|---|---|
| Datum | Annulus drukken (Bar) | |
| | 1st | 2nd |
| 09/01/2015 | 0 | 0 |
| 16/01/2015 | 0 | 0 |
| 21/01/2015 | 5 | 6 |
| 29/01/2015 | 4 | 3.5 |
| 19/02/2015 | 4 | 3 |
| 22/03/2015 | 0 | 0 |
| 05/04/2015 | 2 | 1.5 |
| 26/04/2015 | 0 | 0 |
| 23/05/2015 | 0 | 0 |
| 30/05/2015 | 0 | 0 |
| 07/06/2015 | 0 | 0 |
| 21/09/2015 | 0 | 0 |
| 13/10/2015 | 0 | 0 |
| 30/10/2015 | 0 | 0 |
| 09/11/2015 | 0 | 0 |
| 13/11/2015 | 0 | 0 |
| 29/11/2015 | 1 | 0.3 |

## *Mechanische zaken en onderhoud*

Een overzicht van de werkzaamheden aan NSL-01 in 2015 is opgenomen in Bijlage 1.

## *Incidenten of lekkages*

In 2015 hebben zich geen incidenten of lekkages voorgedaan.

## *Vloeistof analyses*

Het te injecteren formatiewater wordt periodiek bemonsterd en geanalyseerd.

De analyse rapportages zijn weergegeven in bijlage 2.

## *Bijlage 1 Rapport van onderhoudswerkzaamheden*

| Omschrijving | Datum |
|---|---|
| Inspectie well control unit | 22/12/2015 |
| Onderhouds werkzaamheden tank D165 level metering | 03/11/2015<br>22/10/2015<br>29/09/2015<br>30/04/2015<br>02/03/2015<br>29/01/2015 |
| Onderhouds werkzaamheden aan SDV811 | 02/10/2015 |
| check injectie pompen nsl | 05/06/2015 |
| Kalibratie flowmeter door Kalibra, | 11/03/2015 |
| Inspectie well control unit | 19/11/2015 |
| Inspectie injectie pompen | 03/07/2015 |

## *Bijlage 2 Vloeistof analyses*

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## ANALYTICAL REPORT SR-1624564.01.A01



| | |
|---|---|
| grade | PROCESWATER |
| sample 001 | Sample received from client<br>Sample packed in glass,quantity approx. 2*1L<br>Sample marked as BRAKEL / 06-01-2015 09:00 |
| date received | 12.01.2015 |

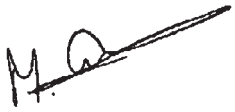
| | 001 |
|---|---|
| Q Density at 20°C, g/cm$^3$<br>(ASTM D 4052) | 1.1251 |
| pH at 20°C<br>(ASTM E 70) | 5.70 |
| Flash point, Pensky Martens closed cup, °C<br>(ASTM D 93 procedure A, modified) | >60 |
| Chloride as $Cl^-$, mg/L<br>(SGS SPI 158) | 112000 |
| Ionchromatographic analysis<br>(SGS SPI 164) | |
| - Sulphate as $SO_4^{2-}$, mg/kg | 220 |
| Total Suspended Solids (>5um), mg/kg<br>(NEN 872) | 89 |
| Gaschromatographic analysis<br>(SGS 2005-18) | |
| - Methylglycol , mg/L | <25 |
| - Ethylglycol, mg/L | <25 |
| - Isopropylglycol , mg/L | <25 |
| - Butylglycol , mg/L | <25 |
| - Dimethylglycol, mg/L | <25 |
| - Ethyleenglycol, mg/L | 4400 |
| - Diethyleenglycol, mg/L | <25 |
| Total Sulfide as S, mg/L<br>(WAC/III/C/040) | <0.050 |

| | |
|---|---|
| Metals (NEN6961/NEN 6966/C1) | |
| - Arsene, µg/l | <10 |
| - Cadmium, µg/l | <1.0 |
| - Chrome, µg/l | 30 |
| - Copper, µg/l | 38 |
| - Lead, µg/l | 44 |
| - Nickel, µg/l | 14 |
| - Zinc, µg/l | 3800 |
| Mercury, µg/L (NEN EN 1483) | <0.10 |
| Bicarbonate as HCO3, mg/L (WAC/III/A/006) | 200 |
| Carbonate as CO3, mg/L (WAC/III/A/006) | <5.0 |
| PAH, µg/L (SGS 12-01) | <30 |
| Volatile components (SIKB3001 / AS-3130) | |
| - Benzene, µg/l | 13000 |
| - Ethylbenzene, µg/l | 140 |
| - Toluene, µg/l | 3500 |
| - m,p Xylene, µg/l | 520 |
| - o-Xylene, µg/l | 320 |
| - sum of Xylenes, µg/l | 830 |
| - sum of BTEX, µg/l | 18000 |
| - Naphthalenes, µg/l | <5.0 |
| Hardness, mgCaCO3/L (calculated from Ca/Mg) | 30000 |
| Minerals Oil (NEN-EN-ISO 9377-2) | |
| - Fraction C10-C12, µg/l | 6900 |
| - Fraction C12-C22, µg/l | 6300 |
| - Fraction C22-C30, µg/l | 1900 |
| - Fraction C30-C40, µg/l | 580 |
| -Total C10-C40, µg/l | 16000 |
| Sum of Arsene, + Mercury + Benzene, µg/L (Calculating) | 13000 |

[Q] Tests marked with Q are performed under RvA Accreditation (L092)

Samples will be retained for 3 months unless instructed otherwise.
***End of analytical results***

Spijkenisse, the 22nd January 2015
**SGS Nederland B.V. - Oil, Gas & Chemicals Services**



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Laboratory Manager

SGS

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## ANALYTICAL REPORT SR-1680104.01.A01



| | |
|---|---|
| grade | PROCESWATER |
| sample 001 | Sample received from client<br>Sample packed in plastic,quantity approx. 2L<br>Sample marked as Location: Slootdorp SLD/6/7<br>Origin: Baker Tank; 13.10.2015 14.30u |
| date received | 23.10.2015 |

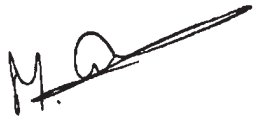
| | 001 |
|---|---|
| Q Density at 20°C, g/cm$^3$<br>(ASTM D 4052) | 1.0679 |
| pH at 20°C<br>(ASTM E 70) | 6.12 |
| Flash point, Pensky Martens closed cup, °C<br>(ASTM D 93 procedure A, modified) | >80 |
| Chloride as $Cl^-$, mg/L<br>(SGS SPI 158) | 55500 |
| Ionchromatographic analysis<br>(SGS SPI 164) | |
| - Sulphate as $SO_4^{2-}$, mg/kg | 400 |
| Total Suspended Solids (>5um), mg/kg<br>(NEN 872) | 550 |
| Elements with ICP<br>(SGS SPI 110) | |
| - Iron as Fe, mg/L | 110 |
| Gaschromatographic analysis<br>(SGS 2005-18) | |
| - Methylglycol , mg/L | <25 |
| - Ethylglycol, mg/L | <25 |
| - Isopropylglycol , mg/L | <25 |
| - Butylglycol , mg/L | <25 |
| - Dimethylglycol, mg/L | <25 |
| - Ethyleenglycol, mg/L | <25 |
| - Diethyleenglycol, mg/L | <25 |

| | |
|---|---|
| Total Sulfide as S, mg/L (WAC/III/C/040) | <0.1 |
| Metals (NEN6961/NEN 6966/C1) | |
| - Arsene, µg/l | <10 |
| - Cadmium, µg/l | <1 |
| - Chrome, µg/l | 120 |
| - Copper, µg/l | 360 |
| - Lead, µg/l | 140 |
| - Nickel, µg/l | 180 |
| - Zinc, µg/l | 1200 |
| Mercury, µg/L (NEN EN 1483) | 1.3 |
| Bicarbonate as HCO3, mg/L (WAC/III/A/006) | 250 |
| Carbonate as CO3, mg/L (WAC/III/A/006) | <5.0 |
| PAH, µg/L (SGS 12-01) | <7.1 |
| Volatile components (SIKB3001 / AS-3130) | |
| - Benzene, µg/l | 2900 |
| - Ethylbenzene, µg/l | 6.8 |
| - Toluene, µg/l | 300 |
| - m,p Xylene, µg/l | 20 |
| - o-Xylene, µg/l | 28 |
| - sum of Xylenes, µg/l | 49 |
| - sum of BTEX, µg/l | 3200 |
| - Naphthalenes, µg/l | 16 |
| Hardness, mgCaCO3/L (calculated from Ca/Mg) | 13350 |
| Minerals Oil (NEN-EN-ISO 9377-2) | |
| - Fraction C10-C12, µg/l | 4700 |
| - Fraction C12-C22, µg/l | 42000 |
| - Fraction C22-C30, µg/l | 5200 |
| - Fraction C30-C40, µg/l | 360 |
| -Total C10-C40, µg/l | 52000 |
| Sum of Arsene, + Mercury + Benzene, µg/L (Calculated) | 2912 |

[Q] Tests marked with Q are performed under RvA Accreditation (L092)

***End of analytical results***

Spijkenisse, the October 30th, 2015
**SGS Nederland B.V. - Oil, Gas & Chemicals Services**



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## ANALYTICAL REPORT SR-1684211.01.A01 A



| | |
|---|---|
| grade | PROCESWATER |
| sample 001 | Sample received from client<br>Sample packed in plastic,quantity approx. 4L<br>Sample marked as Location: Langezwaag 2 / Vlieland water 06-11-2015 |
| date received | 13.11.2015 |

| | | |
|---|---|---|
| [U] Density at 20°C, g/cm$^3$<br>(ASTM D 4052) | 1.1825 | |
| pH at 20°C<br>(ASTM E 70) | 5.6 | |
| Chloride as $Cl^-$, mg/l<br>(SGS SPI 158) | 166000 | 4682 (meq/l) |
| Ionchromatographic analysis<br>(SGS SPI 164) | | |
| - Sulphate as $SO_4^{2-}$, mg/kg | 130 | 1.35 (meq/l) |
| $H_3O^+$, mg/l | <0.5 | <0.5 (meq/l) |
| Hardness, mg$CaCO_3$/l<br>(calculated from Ca/Mg) | 74410 | |
| Sulfide as $H_2S$, mg/l<br>(WAC/III/C/040) | <1 | |

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## ANALYTICAL REPORT SR-1684211.01.A01 A



| | | |
|---|---|---|
| Metals (NEN6961/NEN 6966/C1) | | |
| - Sodium, mg/l | 66000 | 2870 (meq/l) |
| - Potassium, mg/l | 1600 | 40.9 (meq/l) |
| - Calcium, mg/l | 25000 | 624 (meq/l) |
| - Magnesium, mg/l | 3100 | 127.5 (meq/l) |
| - Barium, mg/l | 5.4 | 0.04 (meq/l) |
| - Strontium, mg/l | 1100 | 12.6 (meq/l) |
| - Iron, mg/l | 65 | 1.2 (meq/l) |
| Refractive Index at 20°C (ASTM D 1218) | 1.3796 | |
| Conductivity at 25°C, µS/cm NEN ISO 7888 | 200000 | |
| Resistivity at 25°C, ohm-m | 0.05 | |
| Total Disolved Solids, mg/l (NEN EN 15216) | 263000 | |
| Total Alkalinity, mg $CaCO_3$/l (WAC/III/A/006) | 6615 | |

***End of analytical results***

Spijkenisse, the November 30th, 2015
**SGS Nederland B.V. - Oil, Gas & Chemicals Services**

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## ANALYTICAL REPORT SR-1688647.01.A01



| | |
|---|---|
| grade | PROCESWATER |
| sample 001 | Sample received from client<br>Sample packed in glass, quantity approx. 3 L<br>Sample marked as Slootdorp-7 Wellhead dd. 27-11-2015 |
| date received | 07.12.2015 |

| | | |
|---|---|---|
| [Q] Specific Gravity at 20/20°C, g/cm$^3$<br>(ASTM D 4052) | 1.1073[(01)] | |
| pH at 20°C<br>(ASTM E 70) | 6.3 | |
| Chloride as $Cl^-$, mg/l<br>(SGS SPI 158) | 80000 | 2257 (meq/l) |
| Ionchromatographic analysis<br>(SGS SPI 164) | | |
| - Sulphate as $SO_4^{2-}$, mg/kg | 730 | 7.60 (meq/l) |
| $H_3O^+$, mg/l | <0.5 | <0.5 (meq/l) |
| $OH^-$, mg/l | <0.5 | <0.5 (meq/l) |
| Hardness, mg$CaCO_3$/l<br>(calculated from Ca/Mg) | 19000 | |
| Sulfide as $H_2S$, mg/l<br>(WAC/III/C/040) | <1 | |

## ANALYTICAL REPORT SR-1688647.01.A01



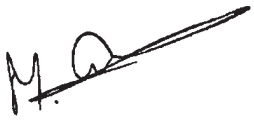
| | | |
|---|---|---|
| Metals (NEN6961/NEN 6966/C1) | | |
| - Sodium, mg/l | 48000 | 2088 (meq/l) |
| - Potassium, mg/l | 1000 | 25.6 (meq/l) |
| - Calcium, mg/l | 6400 | 160 (meq/l) |
| - Magnesium, mg/l | 770 | 31.7 (meq/l) |
| - Barium, mg/l | 2.8 | 0.02 (meq/l) |
| - Strontium, mg/l | 260 | 2.96 (meq/l) |
| - Iron, mg/l | 19 | 0.3 (meq/l) |
| Refractive Index at 20°C (ASTM D 1218) | 1.3593 | |
| Conductivity at 25°C, µS/cm NEN ISO 7888 | 160000 | |
| Resistivity at 25°C, ohm-m | 0.06 | |
| Total Disolved Solids, mg/l (NEN EN 15216) | 207500 | |
| Total Alkalinity, mg $CaCO_3$/l (WAC/III/A/006) | 4650 | |
| Carbonate as $CO_3$, mg/l (WAC/III/A/006) | <2.5 | |
| Bicarbonate as $HCO_3$, mg/l (WAC/III/A/006) | 570 | |

(01) Due to matrix, result is indicative only.(particles present)

***End of analytical results***

Spijkenisse, the 8th December 2015

**SGS Nederland B.V. - Oil, Gas & Chemicals Services**



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## ANALYTICAL REPORT SR-1691933.01.A01



| | |
|---|---|
| grade | PROCESWATER |
| sample 001 | Sample received from client<br>Sample packed in plastic, quantity approx. 4 L<br>Sample marked as Field: Steenwijk / Location: Eesveen<br>Origin: DS 100 (sep) / Date: 17-12-2015 15.30u |
| date received | 22.12.2015 |

| | |
|---|---|
| [Q] Density at 20°C, g/cm$^3$<br>(ASTM D 4052) | 1.1124 |
| pH at 20°C<br>(ASTM E 70) | 5.87 |
| Flash point, Pensky Martens closed cup, °C<br>(ASTM D 93 procedure A, modified) | >80 |
| Chloride as $Cl^-$, mg/L<br>(SGS SPI 158) | 93300 |
| Ionchromatographic analysis<br>(SGS SPI 164) | |
| - Sulphate as $SO_4^{2-}$, mg/kg | <10 |
| Total Suspended Solids (>5um), mg/kg<br>(NEN 872) | 34.0 |

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## ANALYTICAL REPORT SR-1691933.01.A01



| | |
|---|---|
| Metals (NEN6961/NEN 6966/C1) | |
| - Arsene, µg/l | <10 |
| - Cadmium, µg/l | 6.7 |
| - Chrome, µg/l | <5 |
| - Copper, µg/l | 15 |
| - Iron, µg/l | 120 |
| - Lead, µg/l | 10 |
| - Nickel, µg/l | 15 |
| - Zinc, µg/l | 6700 |
| Mercury, µg/L (NEN EN 1483) | <0.10 |
| Bicarbonate as HCO3, mg/L (WAC/III/A/006) | 180 |
| Carbonate as CO3, mg/L (WAC/III/A/006) | <2.5 |
| PAH, µg/L (SGS 12-01) | <3.7 |
| Volatile components (SIKB3001 / AS-3130) | |
| - Benzene, µg/l | 5000 |
| - Ethylbenzene, µg/l | 13 |
| - Toluene, µg/l | 440 |
| - m,p Xylene, µg/l | 96 |
| - o-Xylene, µg/l | 52 |
| - sum of Xylenes, µg/l | 148 |
| - sum of BTEX, µg/l | 5749 |
| - Naphthalenes, µg/l | 27 |

| | |
|---|---|
| Hardness, mgCaCO3/L (calculated from Ca/Mg) | 19675 |
| Minerals Oil (NEN-EN-ISO 9377-2) | |
| - Fraction C10-C12, µg/l | 1200 |
| - Fraction C12-C22, µg/l | 3900 |
| - Fraction C22-C30, µg/l | 590 |
| - Fraction C30-C40, µg/l | 300 |
| -Total C10-C40, µg/l | 5990 |
| Sum of Arsene, + Mercury + Benzene, µg/L (Calculated) | 5000 |
| Total Sulfide as S, mg/L (WAC/III/C/040) | <0.1 |
| Gaschromatographic analysis (SGS 2005-18) | |
| - Methylglycol , mg/L | <2.5 |
| - Ethylglycol, mg/L | <2.5 |
| - Isopropylglycol , mg/L | <2.5 |
| - Butylglycol , mg/L | <2.5 |
| - Dimethylglycol, mg/L | <2.5 |
| - Ethyleenglycol, mg/L | <2.5 |
| - Diethyleenglycol, mg/L | <2.5 |

[Q] Tests marked with Q are performed under RvA ISO 17025 Accreditation (L092)

***End of analytical results***

Spijkenisse, the 4th January 2016
**SGS Nederland B.V. - Oil, Gas & Chemicals**

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