Système de plafonnement et
d'échange de droits d'émission de
gaz à effet de serre

RAPPORT DE PROJET DE CRÉDITS COMPENSATOIRES

Projets de valorisation et de destruction de méthane provenant d'un lieu d'enfouissement

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Captage et destruction des biogaz du LES de Granby
LE014
Période de déclaration couverte par le rapport de projet :
15 juillet 2021 au 31 mars 2022

Terreau Biogaz SEC

Date du rapport de projet : 26 octobre 2022

Instructions aux promoteurs de projets de crédits compensatoires

Le présent gabarit est destiné aux promoteurs de projets de valorisation et de destruction de méthane provenant d'un lieu d'enfouissement. Il permet de préparer un rapport de projet, conformément au Règlement relatif aux projets de valorisation et de destruction de méthane provenant d'un lieu d'enfouissement admissibles à la délivrance de crédits compensatoires (Règlement), en vue de soumettre une demande de délivrance de crédits compensatoires en vertu du Règlement concernant le système de plafonnement et d'échange de droits d'émission de gaz à effet de serre (RSPEDE). L'utilisation du présent gabarit de rapport de projet est obligatoire.

Notez que ce gabarit ne constitue pas une interprétation juridique du RSPEDE ou du Règlement, ni celle d'aucun règlement québécois. Veuillez donc vous référer à la réglementation pour connaitre les exigences applicables.

Le rapport de projet de crédits compensatoires de la **première période de déclaration** permet au promoteur de décrire son projet, de documenter sa mise en œuvre, son admissibilité et de présenter les réductions d'émissions de gaz à effet de serre (GES) quantifiées selon la méthodologie prescrite par le Règlement.

- Pour le premier rapport de projet, toutes les sections du gabarit doivent être remplies.

Le rapport de projet de crédits compensatoires des **périodes de déclaration subséquentes** permet au promoteur de décrire et de documenter les modifications apportées au projet depuis le rapport de projet précédent, le cas échéant, et de présenter les réductions d'émissions de GES quantifiées selon la méthodologie prescrite par le Règlement.

- Pour les rapports de projets des périodes subséquentes à la première, seules les sections indiquées doivent être remplies.
- Tout renseignement ou document modifié depuis le rapport de projet précédent doit être indiqué dans la section appropriée.

Toute information jugée pertinente à l'analyse du projet peut être ajoutée aux sections appropriées.

Finalement, une copie des données brutes mesurées et utilisées aux fins de la quantification, ainsi que les méthodes de calcul et tous les renseignements et documents utilisés pour effectuer la quantification, doivent accompagner tout rapport de projet.

***Important** : Le rapport de projet sera accessible publiquement par l'entremise du registre des projets de crédits compensatoires, sur le site Web du ministère de l'Environnement et de la Lutte contre les changements climatiques (MELCC), à la suite de la délivrance des crédits compensatoires. Si des sections du rapport de projet comportent des renseignements confidentiels, veuillez nous en aviser pour qu'elles soient retirées du document avant sa publication.*

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1. Identification des personnes participant au projet

1.1 Renseignements sur le promoteur du projet et les personnes ou professionnels participant à la préparation ou à la réalisation du projet

Renseignements sur le promoteur du projet	
Promoteur	
Nom du promoteur	Terreau Biogaz SEC
Adresse	1327, avenue Maguire, Québec (QC) G1T 1Z2
Numéro de téléphone	418 476-1686
Adresse courriel	rino.dumont@groupeth.com
Représentant du promoteur	
Nom du représentant	Rino Dumont, Président
Coordonnées au travail	1327, avenue Maguire, Québec (QC) G1T 1Z2
Numéro de téléphone	418 476-1686
Adresse courriel	rino.dumont@groupeth.com

Renseignements sur les personnes ou les professionnels participant à la préparation ou à la réalisation du projet	
Nom	Tetra Tech QI inc.
Adresse	1205, rue Ampère, Boucherville (QC) J4B 7M6
Numéro de téléphone	450 655-8440
Adresse courriel	guillaume.nachin@tetratech.com
Résumé des tâches	Support technique au Promoteur, préparation des documents, quantification des réductions de GES
Représentant	
Nom du représentant	Guillaume Nachin, ing. M.Ing
Coordonnées au travail	7275, rue Sherbrooke E, bur.600, Montréal (QC) H1N 1E9
Numéro de téléphone	514 884-0186
Adresse courriel	guillaume.nachin@tetratech.com

1.2 Renseignements sur les autres personnes participant au projet

Renseignements sur le propriétaire du site du projet (si différent du promoteur)	
Nom du propriétaire	GFL Environnement
Adresse	702 route 137 Sud, Ste-Cécile de Milton
Numéro de téléphone	450-372-2399
Adresse courriel	slapointe@matrec.ca
Représentant	
Nom du représentant	M. Sébastien Lapointe, Directeur de l'ingénierie et conformité environnementale
Coordonnées au travail	10930 rue Sherbrooke Est, Montréal (QC) H1B 1B4
Numéro de téléphone	450 641-3070
Adresse courriel	slapointe@matrec.ca

2. Description détaillée du projet

En accord avec GFL Environnement, ci-après appelé GFL, Terreau Biogaz SEC (« Terreau Biogaz ») a mis en place un projet de réduction des gaz à effet de serre (« GES ») sur le lieu d'enfouissement sanitaire (« LES »). Ce projet est situé sur le territoire de la municipalité de Sainte-Cécile-de-Milton dans la M.R.C. de la Haute-Yamaska.

Le LES de GFL a été fermé en 2008. GFL n'a aucune obligation réglementaire de capter et détruire le biogaz du LES. GFL a cédé ses droits gaziers sur ce LES, distinct du LET, à une entité privée nommée Terreau Biogaz.

Un réseau de captage a été aménagé sur le site afin de collecter le biogaz formé à la suite de la décomposition anaérobie des matières résiduelles enfouies. Le biogaz est collecté par des puits verticaux dans un réseau de conduites souterraines et acheminé vers des équipements de combustion, pour valorisation énergétique ou destruction du biogaz. Les équipements de combustion installés au site sont:

- une centrale de cogénération, comprenant deux (2) unités ayant chacune 1,06 MW de puissance électrique nominale et 600 kW de puissance thermique. Chaque unité consiste en un moteur à combustion interne Jenbacher couplé à une génératrice;
- deux (2) unités de destruction thermique (torchères à flamme invisible).

Terreau Biogaz est propriétaire de la centrale de cogénération. GFL est propriétaire des torchères à flamme invisible.

Les biogaz collectés dans le site sont dirigés, par un jeu de vannes, vers l'un ou l'autre des systèmes de destruction. Les opérations priorisent la centrale de cogénération, qui produit de l'électricité injectée sur le réseau d'Hydro-Québec et de la chaleur de procédé utilisée pour le traitement des eaux usées du lieu d'enfouissement. Les torchères sont utilisées pour détruire les volumes de biogaz que la centrale de cogénération n'a pas la capacité de valoriser, et également en relève lors de l'arrêt partiel ou complet de la centrale de cogénération.

La centrale fonctionne et produit de l'électricité 24 heures par jour, toute l'année. La disponibilité du système est supérieure à 95 %. Les seuls arrêts sont imputables à des bris ou à des arrêts pour maintenance. Un système de télémétrie avec enregistreur de données permet de suivre en temps réel et en permanence le bon fonctionnement des équipements. Un employé est présent sur le site de jour, 5 jours par semaine. Dans le cas de l'arrêt partiel ou complet de la centrale de cogénération, les biogaz soutirés sont acheminés par un jeu de vannes vers les torchères à flamme invisible pour destruction. Il est impossible, par conception, que le biogaz soutiré soit émis à l'atmosphère sans avoir été détruit ou brûlé. Le système fonctionne en circuit fermé : en cas d'arrêt d'un moteur, le système maintient la conduite d'alimentation en surpression et tente un redémarrage automatique. Si le redémarrage échoue, alors les vannes sont ajustées automatiquement pour acheminer le biogaz vers les torchères.

Il importe de préciser que le biogaz provenant du LET, site réglementé, est aussi capté et brûlé dans les mêmes équipements de valorisation ou destruction que le biogaz du LET. En raison des exigences réglementaires du REIMR qui régit l'exploitation du LET, ce dernier ne peut pas être éligible à un projet de crédits compensatoires. À ce titre, le LET est muni de son propre réseau de captage et de son propre système de mesurage (débitmètre, analyseur de gaz). Ainsi, les débits et la qualité du biogaz provenant du LES et du LET sont mesurés et enregistrés séparément. La quantification des réductions de

GES permises par le projet de crédits compensatoires s'appuie exclusivement sur les données du LET.

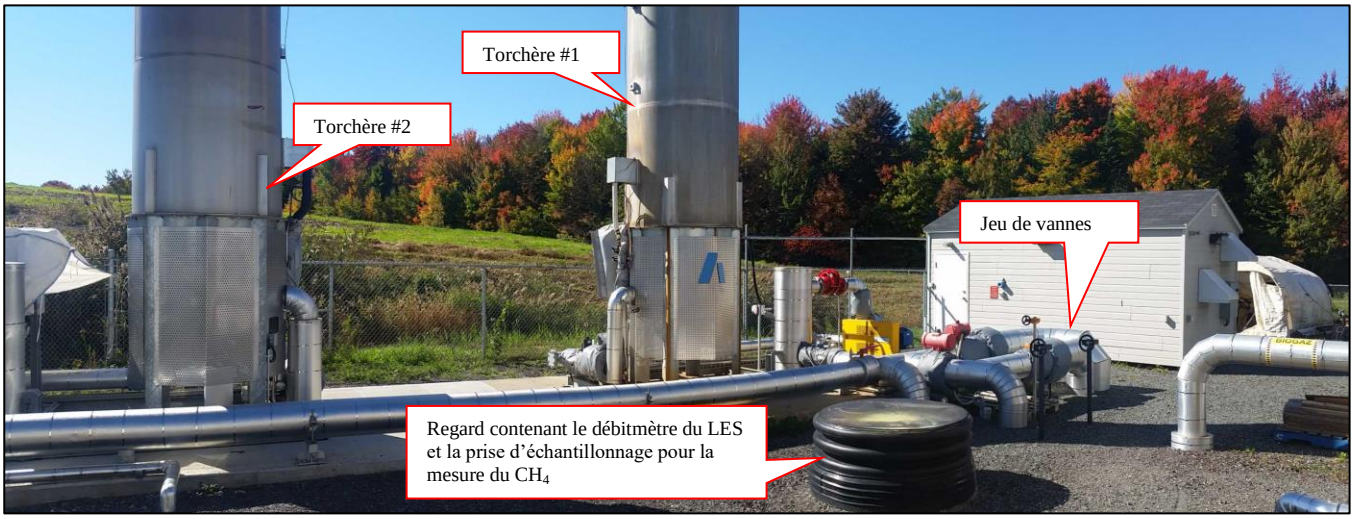


Figure 1 Unités de destruction thermique (torchères à flamme invisible)

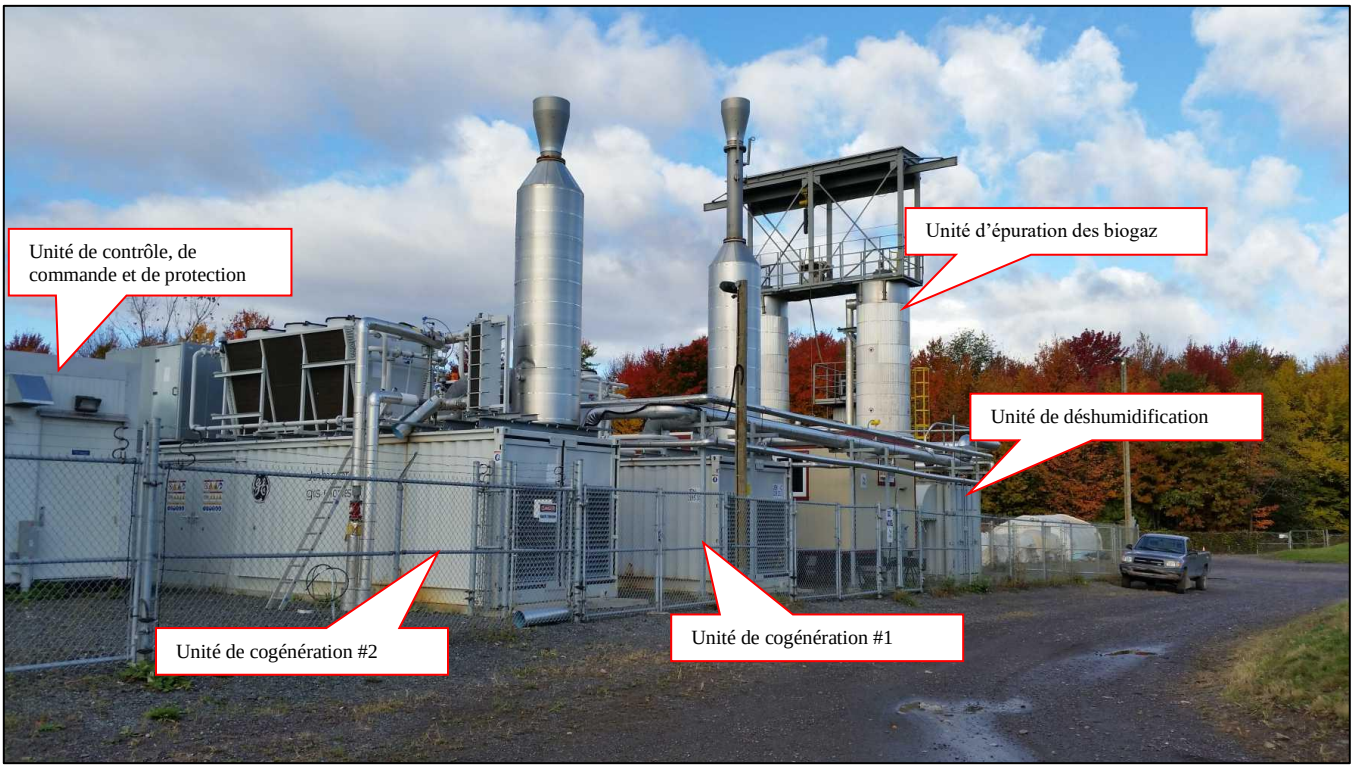


Figure 2 Vue d'ensemble de la centrale de cogénération

Figure 3 Centrale de cogénération

3. Modifications apportées au projet depuis le rapport de projet précédent

Sans objet.

4. Admissibilité

4.1 Localisation des sites du projet

Coordonnées municipales du site de projet	702 route 137 Sud, Sainte-Cécile-de-Milton
Longitude et latitude de chaque site (coordonnées de positionnement global [GPS])	45° 27' 38" N 72° 46’ 28" O

4.2 Conditions spécifiques au lieu d'enfouissement

Lieu d'enfouissement en exploitation	
Quantité de matière résiduelle reçue durant la période de déclaration visée par le rapport de projet (tonnes métriques)	0
Capacité autorisée (m^3)	Non inscrite à l'autorisation de ce site non règlementé ayant terminé ses activités avant le 19 janvier 2009.

Précisez si le lieu d'enfouissement a l'obligation, au moment du dépôt de l'avis de projet ou de l'avis de renouvellement, de capter et détruire le méthane.	Les réductions d'émissions de GES sont réalisées à l'initiative du promoteur. Le projet est volontaire en ce sens qu'il n'est pas réalisé, au moment de son enregistrement ou de son renouvellement, en raison d'une disposition législative ou réglementaire, d'un permis, de tout autre type d'autorisation, d'une ordonnance rendue en vertu d'une loi ou d'un règlement ou d'une décision d'un tribunal.

4.3 Dispositif de destruction

Dispositif de valorisation ou de destruction	
Indiquez le ou les dispositifs de destruction ou de valorisation utilisés dans le cadre du projet.	Unité de cogénération de 2.12 MW et en relève, deux torchères à flamme invisible de Hofstetter de 800 m³/h chacune
Efficacité de destruction utilisée	0,936 (Annexe « A » , moteur à combustion interne)

5. Quantification des réductions d'émissions de GES attribuables au projet

Les SPR visés par le projet sont ceux montrés à la Figure 1 de l'Annexe B du *Règlement relatif aux projets de valorisation et de destruction de méthane provenant d'un lieu d'enfouissement admissibles à la délivrance de crédits compensatoires.*

Les SPR à considérer sont ceux à l'intérieur de l'encadré en pointillés de la figure précédente. Parmi les six (6) SPR à considérer :

- Le SPR 4 représente les émissions de GES dues à la décomposition des matières résiduelles. Les émissions diffuses de méthane à la surface du LES ne sont pas connues, puisqu'elles peuvent être estimées par calcul théorique mais ne peuvent pas être mesurées directement. Les émissions de GES calculées pour ce SPR correspondent à la **portion du biogaz qui aurait été émise à l'atmosphère en l'absence de projet**
- Les émissions du SPR 5 sont négligeables par rapport aux réductions permises par le projet (écart supérieur à 8 ordres de grandeur selon un calcul préliminaire);
- Les SPR 6 et SPR 8 et SPR 9 sont directement applicables au Projet.
- Le SPR 7 est moins important dans ce Projet par rapport à la valorisation.

Le tableau de la section 5.1 suivante résume les SPR retenus pour les scénarios de référence et de projet.

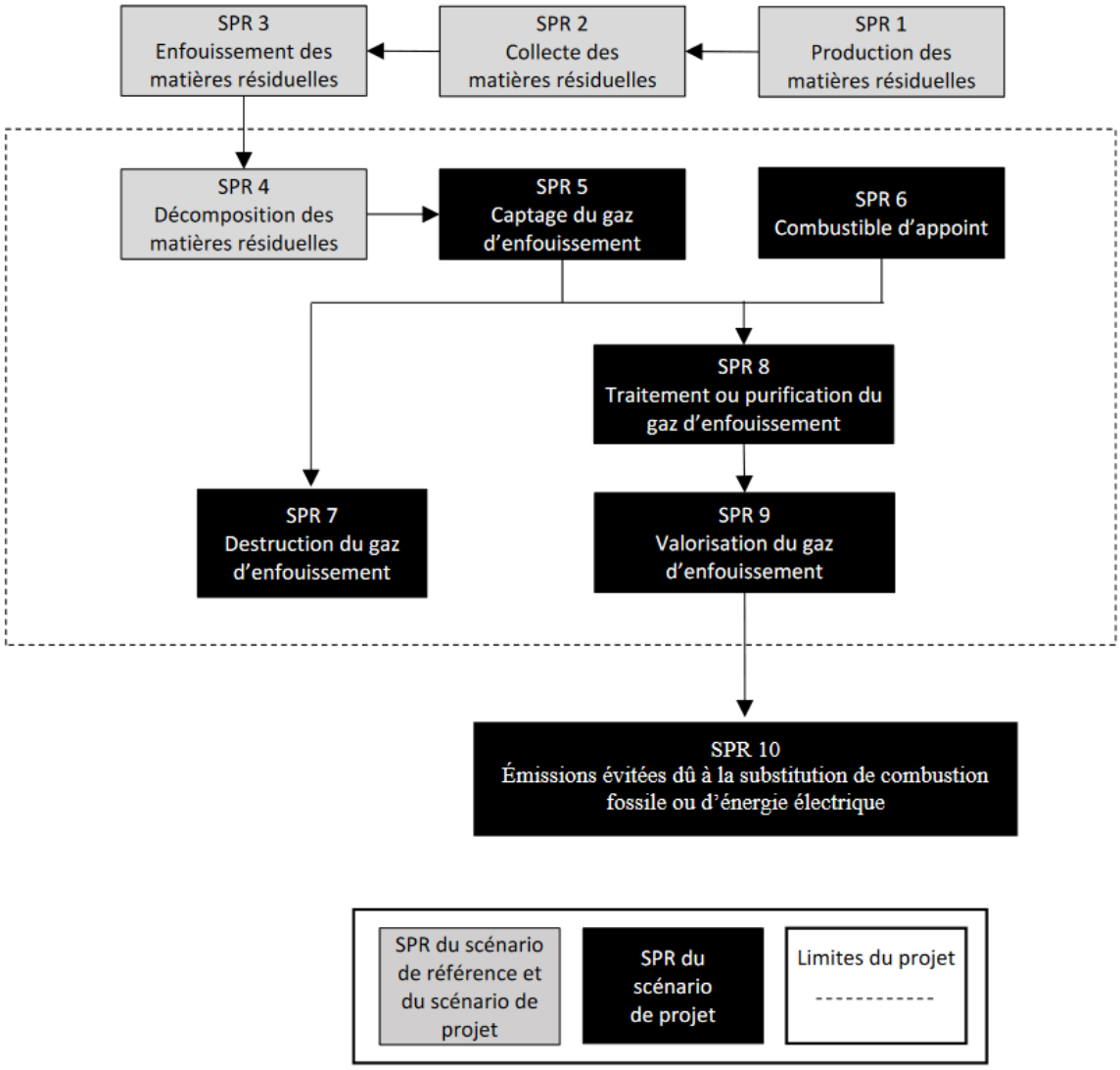


Figure 1 – Illustration des limites du système

(figure tirée de l'Annexe B du Règlement)

5.1 Sources, puits et réservoirs de GES (SPR) du projet

Nº SPR	Description	GES visés	Scénario de référence et/ou scénario de projet
4	Décomposition des matières résiduelles – Fraction qui aurait été émise à l'atmosphère en l'absence de Projet	CH_4	R, P

6	Combustible d'appoint	CO_2 CH_4 N_2O	P
9	Valorisation du gaz d'enfouissement	CH_4	P

5.2 Méthodes de calcul applicables à la quantification

Le calcul du facteur d'oxydation est basé sur le type de recouvrement du LES et celui-ci est en sol donc il est de 10%.

En ce qui concerne les émissions du scénario de projet : la centrale de cogénération brûlant la grande majorité des biogaz devient la référence de ce projet. La torchère n'est qu'un appoint dans le cas de bris de la centrale est assimilée à la valorisation en termes de facteur d'efficacité de destruction pour simplifier les calculs des réductions.

La torchère qui est en fonction que très rarement lors d'arrêt de la centrale démarre généralement avec du biogaz. Il y a une possibilité de démarrer également avec bonbonne de propane de 20 litres présente en tant que solution d'urgence mais ce n'est pas utilisée dans les conditions normales. La bonbonne n'a pas été remplie ou remplacée durant la période de déclaration. La quantité de propane utilisée est nulle. Les émissions du scénario de projet sont nulles.

Équation 1 : *RÉ = ÉR - ÉP*	
Paramètre	**Valeur**
RÉ = Réductions d'émissions de GES attribuables au projet, en tonnes métriques en équivalent CO_2	7 100 t-CO_2e
ÉR = Émissions de GES du scénario de référence, calculées selon l'équation 2 de l'article 20, en tonnes métriques en équivalent CO_2	7 100 t-CO_2e
ÉP = Émissions de GES du scénario de projet attribuables à la consommation de combustible fossiles, calculées selon l'équation 9 de l'article 22, en tonnes métriques en équivalent CO_2	0 t-CO_2e
Équation 3 : $OX = \frac{(0\,\% \times S_{ZC}) + (10\,\% \times S_{ZNC})}{S_{ZC} + S_{ZNC}}$	
Paramètre	**Valeur**
OX = Facteur d'oxydation utilisé	10 %
S_{ZNC} = Superficie de la zone en exploitation du lieu d'enfouissement non couverte par la géomembrane du recouvrement final au début de la période de déclaration (m^2)	100 %
S_{ZC} = Superficie de la zone du lieu d'enfouissement remplie et couverte par une géomembrane (m^2)	0 m²
Équation 8 : $VGE_{i,t} = VGE_{noncorrigé} \times \frac{293{,}15}{T} \times \frac{P}{101{,}325}$	

Les valeurs de débit sont normalisées aux conditions de référence prévues au Règlement, selon l'équation 8 ci-dessus.	
Équation 9 : $\text{ÉP} = \sum_{f=1}^{n} \left[CF_f \times \left[(F\text{É}_{CO2,f} \times 10^{-3}) + (F\text{É}_{CH4,f} \times PRP_{CH4} \times 10^{-6}) + (F\text{É}_{N2O,f} \times PRP_{N2O} \times 10^{-6}) \right] \right]$	
ÉP = Émissions de GES du scénario de projet attribuables à la consommation de combustible fossiles, en tonnes métriques en équivalent CO_2	0
f = Type de combustible fossile	Propane
n = Nombre de types de combustible fossiles	1
CF_f = Quantité totale de combustible fossile *f* consommée	0 litres
$F\text{É}_{CO2,f}$ = Facteur d'émission de CO_2 du combustible fossile	1,510 kg/l
$F\text{É}_{CH4,f}$ = Facteur d'émission de CH_4 du combustible fossile *f*	0,024 g/l
PRP_{CH4} = Potentiel de réchauffement planétaire du CH_4	25
$F\text{É}_{N2O,f}$ = Facteur d'émission de N_2O du combustible fossile *f*	0,108 g/l
PRP_{N2O} = Potentiel de réchauffement planétaire du N_2O	298

5.3 Problème survenu

Non applicable.

5.4 Données manquantes

Période de données manquantes	Types de données manquantes	Méthode de remplacement utilisée	Valeur utilisée
21/01/2022 01h03 à 18h31	Débit de biogaz	Annexe C du Règlement (Chapitre Q-2, r. 35.5) Période : 6 à moins de 24 heures	144,7 Nm³/h

5.5 Réductions d'émissions de GES attribuables au projet

Numéro de la période de déclaration	Dates de la période de déclaration		Millésime[1]	Quantité totale de réductions d'émissions de GES déclarée (tm éq. CO_2)
	Date de début (aaaa-mm-jj)	Date de fin (aaaa-mm-jj)		
1	2021-07-15	2021-12-31	2021	4 839
1	2022-01-01	2022-03-31	2022	2 261
				Total : 7 100

6. Surveillance du projet

6.1 Plan de surveillance

Cette section présente le plan et les méthodes de surveillance, de mesure et de suivi du projet ainsi que les méthodes d'acquisition des données nécessaires aux calculs des réductions d'émissions de GES. Elle décrit aussi les processus de gestion des données, de surveillance du projet et d'entretien des équipements qui sont mis en œuvre.

Respect des exigences prévues par le règlement

Les calculs ont été effectués avec les équations présentées à la Section II du Règlement. Les données réelles provenant du système sont utilisées : débitmètre et analyseur de méthane.

La collecte des données et la surveillance du projet sont effectuées selon la Section III du Règlement.

Les instruments de mesure répondent aux exigences des articles 25 à 27 du Règlement.

À chaque fin de période de référence, un rapport de réduction des émissions est effectué. Le présent rapport fait état de la réduction des émissions pour la période du 15 juillet 2021 au 31 mars 2022. La conformité des données, surveillance, calculs, etc., présentés est vérifiée par un organisme externe accrédité ISO 14065.

Entretien des équipements

Le personnel de Terreau assure une présence régulière au site, et effectue une maintenance préventive et corrective au besoin de toutes les composantes techniques du système.

Méthodes d'acquisition des données

L'analyseur de gaz en continu mesure le taux de CH_4 dans le biogaz soutiré du lieu d'enfouissement avant son entrée à la torchère. Un débitmètre et des transmetteurs de pression et de température sont également placés avant la torchère. Ceux-ci permettent la mesure et l'enregistrement des données concernant le débit réel du gaz brûlé (m^3/h), sa température d'entrée (°C) et sa pression (mbar) ainsi que le taux de méthane (% v/v).

[1] Le millésime est l'année civile au cours de laquelle les réductions d'émissions de GES ont eu lieu et sont quantifiées. Si une période de déclaration chevauche deux années civiles, les réductions d'émissions de GES doivent être quantifiées séparément pour chaque millésime.

Les paramètres mesurés en continu permettent de calculer la quantité (volume normalisé et masse) de méthane détruit à la torchère. La normalisation du débit (Nm³/h) aux conditions de référence se fait automatiquement par le système, en utilisant la formule suivante :

$$Q\ [\frac{Nm^3}{h}] = \frac{P\ [atm]}{P_{Ref}\ [atm]} * \frac{T_{Ref}\ [°\ K]}{T\ [°\ K]} * Q\ [\frac{m^3}{h}]$$

Où : Q Débit de biogaz

P Pression réelle

P_{Ref} Pression de référence (1 atm)

T Température réelle

T_{Ref} Température de référence (0 ° C ou 273,15 ° K)

Il doit être souligné que les débits de biogaz collectés sont normalisés à 20 °C lors du traitement des données pour le calcul des réductions. Les volumes de CH_4 collectés et détruits qui sont inscrits au présent rapport sont exprimés dans les conditions de référence préconisées par le Règlement.

Les données sont par la suite envoyées à un enregistreur de données automatiques. L'ensemble des paramètres pertinents enregistrés sur l'enregistreur de données local est transféré en temps réel, via Internet, à un poste de surveillance distant. Celui-ci permet de suivre le fonctionnement de la torchère en continu et répondre rapidement si une intervention terrain est nécessaire.

En guise de système de sauvegarde des données, le poste de surveillance distant est muni d'un double disque dur miroir d'une capacité de 150 giga-octets. Il est également muni d'un système d'alimentation sans interruption (ASI) qui lui assurera un fonctionnement en cas de panne de courant, ainsi que d'une protection contre les surintensités et les perturbations de réseaux électriques.

Le détail technique des équipements en place est joint à l'Annexe 9.

Plan de surveillance et de gestion des données

Le plan de surveillance pour effectuer la mesure et le suivi des paramètres du projet est montré au Tableau 6.1.

Tableau 6.1 Plan de surveillance du projet

Paramètre	Description du paramètre	Unité de mesure	Méthode	Fréquence de mesure	Responsable
SZNC	Superficie de la zone en exploitation du lieu d'enfouissement non couverte par une géomembrane	%	Constante	Au début du projet et équivaut à 100 % de la surface	Information évidente obtenue par Terreau Biogaz
$VGE_{i,t}$	Volume corrigé de gaz d'enfouissement dirigé vers le dispositif de valorisation ou de destruction *i*, durant l'intervalle *t*	Mètres cubes aux conditions de référence	Mesuré	En continu, enregistrée toutes les 15 minutes et totalisé sous forme de moyenne au moins une fois par jour	Terreau Biogaz
$C_{CH4,t}$	Concentration moyenne de CH4 dans le gaz d'enfouissement durant l'intervalle *t*	Mètres cubes aux conditions de référence par mètre cube de gaz d'enfouissement aux conditions de référence	Mesuré	En continu, enregistrée toutes les 15 minutes et totalisé sous forme de moyenne au moins une fois par jour	Terreau Biogaz
$VGE_{noncorrigé}$	Volume non corrigé du gaz d'enfouissement capté durant l'intervalle donné	Mètres cubes	Mesuré	Seulement lorsque les données de débit ne sont pas ajustées aux conditions de référence	Terreau Biogaz
T	Température du gaz d'enfouissement	°C	Mesuré	En continu	Terreau Biogaz
P	Pression du gaz d'enfouissement	kPa	Mesuré	En continu	Terreau Biogaz
CF_f	Quantité totale de combustible fossile f consommé	Kilogramme (solide) Mètres cubes aux conditions de référence (gaz) Litres (liquide)	Calculé en fonction des registres d'achat de combustibles fossiles	À chaque période de déclaration	Terreau Biogaz
N/A	État de fonctionnement des dispositifs de valorisation ou de destruction	Degré Celsius ou autres, conformément à la présente section	Mesuré pour chaque dispositif de valorisation ou de destruction	Horaire	Terreau Biogaz
N/A	État de fonctionnement du thermocouple ou du dispositif de suivi du dispositif de valorisation ou de destruction		Mesuré	Horaire pour le thermocouple et indéterminé pour les autres dispositifs de suivi	Terreau Biogaz
Assurance-qualité	Volume annuel de gaz	N/A	Bilan de masse Vérifications	Annuellement, lors de la compilation des données d'opération de la période de projet	Tetra Tech

Paramètre	Description du paramètre	Unité de mesure	Méthode	Fréquence de mesure	Responsable
Assurance-qualité intégrité des données	Vérification de l'intégrité des données et méthode de remplacement des données manquantes (débitmètre et analyseur de gaz)	N/A	Selon l'article 23 du règlement Q-2, r. 35.5 (Annexe C)	Annuelle	Tetra Tech
N/A	Calibrations débitmètre	N/A	Selon la méthode du manufacturier	Annuelle	Manufacturier Endress+Hauser
N/A	Calibrations analyseur de gaz	N/A	Selon la méthode du manufacturier	Annuelle	Tetra Tech
N/A	Entretien, nettoyage et inspection des équipements	N/A	Selon les préconisations des manufacturiers Endress+Hauser et GE Energy	Selon le calendrier prévu aux plans de maintenance des équipements - Torchère : « Plan de maintenance » - Génératrices : « Plan d'entretien type 3B »	Terreau Biogaz

6.2 Entretien, vérification et étalonnage du débitmètre et de l'analyseur de méthane

Débitmètre	
Type :	Débitmètre de type « thermique massique »
Modèle :	FCI Model ST98
Numéro de série :	413922-A
Date de la vérification	24 mars 2022
Compagnie responsable de la vérification ou de l'étalonnage	Tetra Tech QI inc.
$Erreur\ relative\ (\%) = \frac{\mathrm{M}_{\text{inst projet}} - \mathrm{M}_{\text{inst référence}}}{\mathrm{M}_{\text{inst projet}}} \times 100$	Erreur relative = -1,9%
$M_{inst\ projet}$ = Mesure des instruments du projet, soit le débit volumique du gaz d'enfouissement mesuré par le débitmètre du projet	129,0
$M_{inst\ référence}$ = Mesure des instruments de référence, soit le débit volumique du gaz d'enfouissement mesuré par un débitmètre de référence ou un tube de Pitot de type L	131,5
Si un étalonnage était requis à la suite de la vérification, veuillez l'indiquer et préciser la date et le nom de la compagnie responsable ayant effectué ces travaux.	N/A

Analyseur de CH_4	
Type :	Analyseur de gaz ExTox
Modèle :	ET-4D2
Numéro de série :	B11-511714-004
Date de la vérification ou de l'étalonnage	24 mars 2022
Compagnie responsable de la vérification	Tetra Tech QI inc.
$Erreur\ relative\ (\%) = \frac{\mathrm{M}_{\text{inst projet}} - \mathrm{M}_{\text{inst référence}}}{\mathrm{M}_{\text{inst projet}}} \times 100$	Erreur relative = -1,4 %
$M_{inst\ projet}$ = Mesure des instruments du projet, soit la concentration de CH_4 du gaz d'enfouissement mesurée par l'analyseur de CH_4 du projet	51,3 %
$M_{inst\ référence}$ = Mesure des instruments de référence, soit la concentration de CH_4 du gaz d'enfouissement mesurée par un analyseur de CH_4 de référence	52,0 %
Si un étalonnage a été fait, veuillez l'indiquer et préciser la date et le nom de la compagnie responsable ayant effectué ces travaux.	Tetra Tech QI 24/03/2022

6.3 Dispositif de destruction ou de valorisation du méthane

Dispositif de destruction autre qu'une torche	
Précisez le type de dispositif de suivi du dispositif de destruction.	Non applicable.
Décrivez comment le dispositif de suivi permet de vérifier l'état de fonctionnement du dispositif de valorisation ou de destruction.	Un débitmètre mesure les données de débit en continu et les collige dans une base de données. Une mesure de méthane est également faite séparément sur le biogaz qui provient du LES. En ce qui concerne le bon fonctionnement des équipements de valorisation ou de destruction : • La température de combustion des torchères est mesurée et enregistrée • Les paramètres d'opération de la centrale de cogénération sont suivis et enregistrés, parmi lesquels : débit d'alimentation, qualité du biogaz, puissance électrique fournie. Un technicien est présent à temps plein, de jour, pour le suivi de la centrale. Également, une facture de vente d'électricité de Terreau à Hydro-Québec est jointe en Annexe 12 (preuve récente que la centrale fonctionne et fournit de l'énergie au réseau)

7. Organisme de vérification

Organisme de vérification	
Nom de l'organisme de vérification	Enviro-Accès inc.
Nom de l'organisme d'accréditation	Conseil canadien des normes (CCN), secteur technique « G3 SF Décomposition des déchets, manipulation et élimination »
Date de la visite du site du projet, le cas échéant	25/04/2022

8. Déclarations

8.1 Déclaration du promoteur du projet

En tant que promoteur du projet de crédits compensatoires *Captage et destruction des biogaz du LES de Sainte-Cécile-de-Milton [LE014]*, ou que représentant dudit promoteur exerçant mes activités au sein de l'entité nommée ci-dessus, je déclare que :

- les réductions d'émissions de GES visées par le rapport de projet n'ont pas déjà fait l'objet de la délivrance de crédits compensatoires en vertu du Règlement concernant le système de plafonnement et d'échange de droits d'émission de gaz à effet de serre, ou de crédits en vertu d'un autre programme de compensation d'émissions de GES, et que ces réductions d'émissions ne feront pas l'objet de la délivrance de crédits en vertu d'un tel programme;
- le projet est réalisé conformément à toutes les exigences qui lui sont applicables selon le type de projet et le lieu où il est réalisé;
- le projet est réalisé conformément au Règlement et que les documents et renseignements fournis dans le présent rapport de projet sont complets et exacts.

Terreau Biogaz SEC

Nom du promoteur (dénomination sociale dans le cas d'une personne morale **ou nom et prénom** dans le cas d'une personne physique)

Signature du promoteur (dans le cas d'une personne physique) **ou du représentant du promoteur** (dans le cas d'une personne morale)

2022-06-03

Date de signature (aaaa-mm-jj)

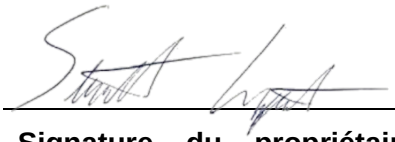
Le cas échéant,

Rino Dumont, Président

Nom et prénom du représentant du promoteur

8.2 Déclaration du propriétaire du site du projet (si différent du promoteur)

En tant propriétaire du site du présent projet de crédits compensatoire *Captage et destruction des biogaz du LES de Sainte-Cécile-de-Milton [LE014]* du promoteur Terreau Biogaz SEC, je déclare que j'ai autorisé la réalisation du projet par le promoteur et que je m'engage à ne pas faire, à l'égard des réductions d'émissions de GES visées par le rapport de projet, de demande de délivrance de crédits compensatoires en vertu du Règlement concernant le système de plafonnement et d'échange de droits d'émission de gaz à effet de serre ou de demande de délivrance de crédits en vertu d'un autre programme de compensation d'émissions de GES.

GFL Environnement	
Nom du propriétaire (dénomination sociale dans le cas d'une personne morale **ou nom et prénom** dans le cas d'une personne physique)	
	2022-05-30
Signature du propriétaire (dans le cas d'une personne physique) **ou du représentant du propriétaire** (dans le cas d'une personne morale)	**Date de signature** (aaaa-mm-jj)

8.3 Déclaration du professionnel

En tant que représentant du professionnel intervenant dans la préparation et la réalisation du projet de crédits compensatoires *Captage et destruction des biogaz du LES de Sainte-Cécile-de-Milton [LE014]* du promoteur Terreau Biogaz, je déclare que les renseignements et les documents fournis sont complets et exacts.

2022/06/06

Guillaume Nachin, ing., M.Ing

Chargé de projet, Tetra Tech QI inc.

OIQ # 5023119

Annexes

Annexe 1 – Analyse d’impacts environnementaux

Non applicable.

Annexe 2 – Aide financière

Non applicable.

Annexe 3 – Localisation du site de projet


Centrale de cogénération
LES
Erablière Martin SENC
137
Roland Thibault Inc
702 QC-137
137

Annexe 4 – Registre d’exploitation du lieu d’enfouissement

Tonnages de matières résiduelles enfouis au LES de Granby

Année	Tonnage enfoui	Année (suite)	Tonnage enfoui (suite)	Année (suite)	Tonnage enfoui (suite)
	t.m.		t.m.		t.m.
1955	13 578	1973	27 506	1991	55 989
1956	14 121	1974	28 606	1992	50 528
1957	14 685	1975	29 750	1993	33 574
1958	15 273	1976	30 940	1994	33 758
1959	15 884	1977	32 178	1995	50 514
1960	16 519	1978	33 465	1996	37 336
1961	17 180	1979	34 803	1997	20 673
1962	17 867	1980	36 195	1998	22 073
1963	18 582	1981	37 643	1999	22 602
1964	19 325	1982	39 149	2000	18 495
1965	20 098	1983	40 715	2001	20 614
1966	20 902	1984	42 343	2002	21 965
1967	21 738	1985	44 037	2003	31 184
1968	22 602	1986	45 799	2004	39 113
1969	23 512	1987	47 631	2005	73 010
1970	24 452	1988	49 536	2006	55 408
1971	25 430	1989	51 517	2007	52 717
1972	26 448	1990	58 578	2008	102 127

Les opérations dans l'ancien lieu d'enfouissement sanitaire se sont terminées le 18 janvier 2009. La superficie comblée est présentée sur le plan faisant état de la progression des opérations joint ci-après. À noter que le recouvrement final a été appliqué à cette partie et qu'elle sera végétalisée au printemps 2010.

En 2009 Roland Thibault Inc. a initié l'exploitation d'en nouvelle cellule, la 1A. Cette dernière n'a pas reçu recouvrement final. Tel que demandé à l'article 52, deuxième alinéa du REIMR, vous trouverez ci-après, un plan faisant état de la progression des opérations d'enfouissement incluant les zones de dépôt comblées, celles en exploitation ainsi que la capacité d'enfouissement encore disponible. Ces informations ont été établies suite à un relevé d'arpentage.

Annexe 5 – Autorisations nécessaires à la réalisation du projet

Ministère du
Développement durable,
de l'Environnement
et des Parcs
Québec

Longueuil, le 30 juin 2011

PERMISSION

Terreau Biogaz, société en commandite
4655, boulevard Wilfrid-Hamel
Québec (Québec) G1P 2J7

N/Réf. : 7522-16-01-0001024
400833045

Objet : Construction sur un lieu d'élimination de matières résiduelles désaffecté

Mesdames,
Messieurs,

À la suite de votre demande de permission datée du 24 mars 2011, reçue le 28 mars 2011 et complétée le 30 juin 2011, j'autorise, conformément à l'article 65 de la *Loi sur la qualité de l'environnement* (L.R.Q., chapitre Q-2), le titulaire ci-dessus mentionné à réaliser le projet décrit ci-dessous :

> Construction d'un système de captage de biogaz au 702, route 137, sur le lot 3 556 631 du cadastre du Québec, dans la municipalité de Sainte-Cécile-de-Milton, municipalité régionale de comté de La Haute-Yamaska.

Les documents suivants, ainsi que ceux qui y sont annexés le cas échéant, font partie intégrante de la présente permission :

- Lettre au ministère du Développement durable, de l'Environnement et des Parcs, datée du 24 mars 2011, signée par William Rateaud et Stephen Davidson, ing., concernant « Demande de certificat d'autorisation pour la mise en place d'un système de captage du biogaz sur le LES Roland Thibault inc. »;
- Lettre au ministère du Développement durable, de l'Environnement et des Parcs, datée du 9 juin 2011, signée par William Rateaud et Stephen Davidson, ing., concernant « Demande de certificat d'autorisation pour la mise en place d'un système de captage du biogaz sur le LES Roland Thibault inc. / Ajout d'un système d'air comprimé »;

- Lettre au ministère du Développement durable, de l'Environnement et des Parcs, datée du 30 juin 2011, signée par William Rateaud, concernant « Demande de certificat d'autorisation pour la mise en place d'un système de captage du biogaz sur le LES Roland Thibault inc. ».

En cas de divergence entre ces documents, l'information contenue au document le plus récent prévaudra.

Le projet devra être réalisé conformément à ces documents.

En outre, cette permission ne dispense pas le titulaire d'obtenir toute autre autorisation requise par toute loi ou tout règlement le cas échéant.

Pour le ministre,

PP/SR

Pierre Paquin
Directeur régional
de l'analyse et de l'expertise
de l'Estrie et de la Montérégie

Ministère du
Développement durable,
de l'Environnement
et des Parcs
Québec

Longueuil, le 24 octobre 2011

CERTIFICAT D'AUTORISATION

Terreau Biogaz, société en commandite
4655, boulevard Wilfrid-Hamel
Québec (Québec) G1P 2J7

N/Réf. : 7522-16-01-0000701
400868861

Objet : Aménagement et exploitation d'une centrale de production d'énergie électrique

Mesdames,
Messieurs,

À la suite de votre demande de certificat d'autorisation datée de février 2011, reçue le 24 février 2011 et complétée le 20 octobre 2011, j'autorise, conformément à l'article 22 de la *Loi sur la qualité de l'environnement* (L.R.Q., chapitre Q-2), le titulaire ci-dessus mentionné à réaliser le projet décrit ci-dessous :

> Aménager et exploiter une centrale de production d'énergie électrique située sur le lot 3 556 631 du cadastre du Québec, dans la municipalité de Sainte-Cécile-de-Milton et dans la municipalité régionale de comté de La Haute-Yamaska.

Les documents suivants, ainsi que ceux qui y sont annexés le cas échéant, font partie intégrante du présent certificat d'autorisation :

- Document au ministère du Développement durable, de l'Environnement et des Parcs, intitulé « Centrale de cogénération de la Haute-Yamaska – Roland Thibault inc. », préparé par BPR-Infrastructure inc., daté du 22 février 2011 et signé par William Rateaud;
- Plan no 03698A-C-DB01 révision 6, intitulé « Cogénération – R. Thibault », préparé par BPR-Infrastructure inc., signé et scellé par Stephen Davidson, ing. le 9 juin 2011;
- Document au ministère du Développement durable, de l'Environnement et des Parcs, intitulé « Demande de CA. / Centrale de cogénération de la Haute-Yamaska – Roland Thibault inc. / Étude de dispersion atmosphérique », préparé par BPR-Infrastructure inc., daté du 14 septembre 2011 et signé par William Rateaud;

- Document au ministère du Développement durable, de l'Environnement et des Parcs, intitulé « Demande de CA / Centrale de cogénération de la Haute-Yamaska – Roland Thibault inc. / Plans demandés », préparé par BPR-Infrastructure inc., daté du 21 septembre 2011 et signé par William Rateaud;
- Lettre au ministère du Développement durable, de l'Environnement et des Parcs, datée du 5 octobre 2011, signée par William Rateaud, concernant « Demande de certificat d'autorisation – Réponses aux questions / Centrale de cogénération de la Haute-Yamaska – Roland Thibault inc. »;
- Lettre au ministère du Développement durable, de l'Environnement et des Parcs, datée du 20 octobre 2011, signée par Stephen Davidson, ing., concernant « Demande de certificat d'autorisation / Centrale de cogénération de la Haute-Yamaska – Roland Thibault inc. » et le courriel du 20 octobre 2011 du MDDEP.

En cas de divergence entre ces documents, l'information contenue au document le plus récent prévaudra.

Le projet devra être réalisé et exploité conformément à ces documents.

En outre, ce certificat d'autorisation ne dispense pas le titulaire d'obtenir toute autre autorisation requise par toute loi ou tout règlement le cas échéant.

Pour le ministre,

PP/SR

Pierre Paquin
Directeur régional
de l'analyse et de l'expertise
de l'Estrie et de la Montérégie

Annexe 6 – Facteur d’oxydation

Non applicable.

Annexe 7 – Rôle des personnes responsables

Terreau Biogaz SEC
Captage et destruction du biogaz du lieu d'enfouissement sanitaire de Granby

Rôles et responsabilités

Rôles et responsabilités	Personnes-ressources	Description
Promoteur du projet	Terreau Biogaz SEC 1327, avenue Maguire, bureau 100 Québec (Québec) G1T 1Z2	
Personne-ressource autorisée	Rino Dumont, Président – Terreau Biogaz SEC 418 476-1686 rino.dumont@groupeth.com	
Personne chargée du suivi opérationnel des équipements	Louis-Philippe Robert Gemme – Terreau Biogaz SEC 450 372-7029 louis-p.rg@terreau.ca	Opération des équipements Suivi du bon fonctionnement des équipements et instruments Maintenance
Personne chargée de la surveillance des GES	Louis-Philippe Robert Gemme – Terreau Biogaz SEC	Extraction et compilation de données d'opération (débit, taux de CH_4, température, périodes de fonctionnement) Compilation données consommation énergétique (propane, électricité)
Personne chargé de l'assurance qualité des données	Louis-Philippe Robert Gemme – Terreau Biogaz SEC	Vérification périodique du bon fonctionnement des instruments Coordination des interventions de tiers externes sur les instruments (calibration) Contrevérification des données de biogaz par d'autres paramètres d'opération
Personne chargée de la quantification de réductions de GES et du rapport de projet	Guillaume Nachin, ing. M.Ing – Tetra Tech QI inc. 514 884-0186 guillaume.nachin@tetratech.com	Traitement des données d'opération Calcul des émissions et réductions de GES Rédaction des rapports et formulaires
Personne chargée du contrôle qualité	Guillaume Nachin, ing. M.Ing – Tetra Tech QI inc. 514 884-0186 guillaume.nachin@tetratech.com	Contrevérification des calculs de réductions de GES (recalcul manuel, validation des résultats par d'autres équations)

Annexe 8 – Registres d’entretien

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
15-juil-21	jeu	SG		Lena stop at 12:53 on LEANOX, bypass seems to be the cause, back on production at 13:36. Flare#1 was on during down time Power reductions Lena: Charge temp. before LP TC(intake air) Starts at 45°C - Down time Total: 43mins
16-juil-21	ven	SG		2:26 am both engines down due to Hydro trip.
18-juil-21	dim	SG		Annie stop 10:25 and 12:13 both times on Leanox deviation, Flare#1 was on during both down times. Start back at 11:09 and 12:50 Down time Total: 81min Annie starts misfiring at 15:27(up to 59%) and power reduction-misfire at 15:58(up to 9.4%) - stopped at 16:54 for 5 minutes to change plug #8 Change setting on starting second Blower 48Hz to 50Hz Down time Total: 81 min
19-juil-21	lun	MO, SG, LPRG	Serge brought poles and paint for us to mark LES wells - RT hired contractor to roll (compact) new earth on LES. Afraid of them hitting wellheads. Flare blower VFD was faulted - had to reset.	Lena was running with a cold cyl#4 since 1st restart on July 15. Plug was black on white Si. Cyl 4 also leaking oil down side of block. Did Lena oil change. Turbo filter was clean - put back. Did good bleed of turbo oil pump. Relay for pump has bad (loose) connection. Cyl 2 plug had brown porcelain. - total down time 1.5 hours. Replaced BOP blower 2 silencer. Lena stop 20:30, on Leanox cold cyl#1. Start back 21:21, Flare#1 running during down time. Down time Total: 50 min
20-juil-21	mar	MO, LPRG, SG	started installing well markers in LES	Annie oil change. Also replaced leaking exhaust gasket - cyl11. Down 1:50 hrs Oil delivery.
21-juil-21	mer	LPRG, SG, Roger Fournier	LES auditor on site to complete LES 2020 GES report.	
22-juil-21	jeu	MO, LPRG, SG	Interchanged flare2 TC wires. Reset large breaker powering Extox panel and air flaps. Cleaned and reduced starting electrode gap (high V transformer may need to be replaced). Running flare 2 since flare 3 stopped for Robin to take BCU unit to Pte Claire site.	media change North tower. Engines stopped when bleed hose disconnected. Changed Lena glycol pump. Tightened turbo pump relay contact. Down 2.5 hrs Replaced filter in Parker glycol transfer pump.
24-juil-21	sam	SG	15:18 flare 1 started Flare 2 stopped to increase total flow burnet from 12 inch line. Matrec requested that flow be around 800m3h, but flare 2 could only reach about 690m3h at full blower speed.	15:14 Annie stopped on mains failure. Down time Total: 31min
25-juil-21	dim	LPRG		9:47 both engines tripped - Leanox dev. Down 47 min. BOP was in lock-out, with no alarms present on any devices apart from engines themselves.
26-juil-21	lun	MO		12:13 both engines stop on Leanox dev when BOP goes into lock-out. Was checking towers for condensate (opened drain valve). Vac set point too low - changed from -75.9 back to -74.2. Down 10 min.
27-juil-21	mar	MO, LPRG, Guillaume+4		6:37 Lena starts misfiring, 10:40 at 50% misfires, she starts power reductions. Stopped at 12:38 for 15 min to change plug #2 and plug wire (poor connection - brown powder on plug) changed direction through Fe towers - South now first. Glued rubber strip on UO tank port.
28-juil-21	mer	LPRG	Adjustments in LET-S to recover production. Most notable is 02-04-S wellhead was partially clogged. Cleared it and vac at Cogen dropped 3''wc.	
29-juil-21	jeu	LPRG, SG	Adjustments in LET-S	When to FAMEC pick up extension de chemine 6 pm Annie cyl#2 starts to act up.
30-juil-21	ven	SG		0:02 Annie stops on Leanox - down 36 min. Locked at 1020 kW after starting. 6am misfires start (up to 57%). 13:30 power reductions (up to 7%) 14:30 Annie stopped 8 minutes to change plug #2. 12:00 noon Annie cyl#11 poor connection - false reading (high - up to 780°C) 16:27 Annie stopped for 20 min to change coil and wire #2. Then trips while ramping over 1mW (down 4 min)
02-août-21	lun	MO	many (180) bags of water treatment media in parking area.	Received 2nd oil sample kit for transformer. Added 1/2 pail glycol to Lena (0.8->1.2 bar) Started dismantling wooden engine transport frame.
03-août-21	mar	MO		Joe gave email showing Innio's conclusion on Annie's 3 coupler failures - Main relay closure time not set in XT4 so closing when not in sync. Rebuilt Lena starter (loose connection had been arcing). Both engines stop at 21:04, Leanox exceeded because VFD-M01(BOP blower room fans) stop on overvoltage. Production back at 22:23 Down time total:75mins
04-août-21	mer	SG	Louis in TM replacing flare thermocouple. Was shorting off when reaching higher temperatures. Turns out there was water in the tube. Replaced it with the new build from Pyromation. Also did basic maintenance.	Lena water pump newly change seem to start linking. Water pressure dropping since yesterday 7pm. 20:05 both engines down - same problem with BOP BR fan VFD. Both flare on max during down time and production back at 20:45 Down time total: 50min
05-août-21	jeu	SG	Louis in Neuville to modify pump installation. LET-S all 6 wells to engines adjustement for better production	Lena water pressure seems to stabilize around 0.83 bar, leaking have stop at that pressure. At 18:45 both engines down 3rd time at 22 hours after resetting BOP BR fans VFDs. Both flare on max during down time and production back at 19:30 Down time total: 45min
06-août-21	ven	SG		Lena was leaking glycol at a union close to shield, lost around half a pale Blowers room, all air filters(7) for inlet ventilation duct have been change at 17:30
09-août-21	lun	MO	TTL-JFZ7453(754 109 100) Guillaume Connected to desktop to download Flare data and RedLion files. Flare 2 ran during stoppage- but only ran at 510°C.	5:02 am many messages from Lena including engine start - but she ran continuously. Fixed Lena camera monitor(broken base). Added 1/2 pail glycol.
10-août-21	mar		Cogen gate measurement for new land contract with Matrec	
11-août-21	mer	SG		Annie stop at 07:50 on LEANOX, say ''Request module On/Off'' before the stop , back on at 08:45 Flare#2 was on during down time Same stop later at 22:35 back on at 23:30 and lock production at 1030Kw Flares have failed to start remotly, 55min on just one Engine Power reductions 60Kw during midday Downtime total: 110min
12-août-21	jeu	MO	Veolia came at 6:47 - unannounced(but pick-up requested 3 weeks ago) West of WTP ponds was leveled with earth to make road for crane and pump trucks for their media change. Hot water line's 3rd manhole is covered.	At 22:52 both engines stop (BOP fan again) - down 40 min
13-août-21	ven	SG		At 14:43 Lena stops on Leanox dev. - down 45 min
14-août-21	sam	SG		Lost off internet around 12:30 to 13:30, called Bell Canada problem was on the line At 13:50 received 2 e-mails saying both engines were back online - never got offline emails.
15-août-21	dim			Annie put back to 1065 kw - was locked at 1030 since Thursday.
16-août-21	lun	MO, LPRG		Tightened glycol hose elbow on Lena and added 1/2 pail glycol (0.66-1.1 bar) Replaced blower 3 muffler with elbow and prepared for shipping.
17-août-21	mar	LPRG		

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
18-août-21	mer	MO, LPRG	Hydro replacing power poles along 137 road just south of 11th. Used Flare 2 - only ran at 136°C.	At 10:45 Lena stopped on low oil. Replaced exh gasket on cyl#11. Down 3 hours. 2nd blower muffler(#3) picked up. LouTec delivered large telescopic forklift and manlift. Added stack extension to Annie. Down 4 hours. At 16:48 reset Annie XT4 - screen was frozen for 46 hours (since Mon 18:44) - kept running, but run hours did not change.
19-août-21	jeu	MO, LPRG	Used 1st flare for media change purges - started with propane torch.	Media change South tower. Forklift with low shoulder pivot point would not allow fence to go down to container floor. Ordered pick-ups at 9 & 12 - came at 10:30 and 1pm.
20-août-21	ven	LPRG		At 12:36 Annie stopped on Leanox Dev. Leanox had been oscillating Left Annie in manual at 1040 Kw.
21-août-21	sam			Since dump rad cleaning, Annie seems to be running about 9°C cooler (4° lower water temp with 5° higher room temp - at same production)
22-août-21	dim	LPRG		Switched H2S towers back to north first. No condensate at any of the sample points.
23-août-21	lun	MO, 4x GATe	Louis in TM - Hof Panel 24v supply replaced. Room AC added.	Added 1/2 pail glycol to Annie (0.76-1.1 Bar). GA Techno did stack sampling - Annie. "need >80% of max power" =852 kw - locked Annie at 1000 kw. Replaced fl light near Lena cyl11 and re-attached housing (nut missing).
24-août-21	mar	MO, LPRG, 4x GATe		Lena stack analysis done - running at 1Mw. Tightened 2 leaking couplings on Lena's hoses - added 1/2 pail (0.73->1.14 bar) Removed 2 resistors in Annie M1 panel (oil temp cheats) - displayed oil temp rose 2.2°C per resistor (83.2 - 85.5 - 87.7). Now both engines have water temp about 2° higher than oil temp (Annie had 6.5° diff).
25-août-21	mer	LPRG, SG	transferred well BH01-08-S from flare3 to engines 15h30. Flare3 went from 940 to 890 m3/hr.	
26-août-21	jeu		LET-S and LET-N adjustement in afternoon	
27-août-21	ven		LET-S and LET-N adjustement in afternoon	Midland delivery in afternoon of Extox panel and two cells. Palet was left front of towers.
28-août-21	sam	LPRG		Friday at 17:20 Lena started leaking heavier at preheat loop elbow. Lost 0.46 bar in 19.5 hours, stopping 13:10 at 0.33 bar. Multiple stops of both engines on Leanox - everything back at 17:16. Annie -0.5 hr, Lena -2 hr. At night, increased Lena glycol pressure and tried to install a patch on the leak, but it does not reduce it.
29-août-21	dim	LPRG, SG		tightened Lena leak and added glycol
30-août-21	lun	MO, LPRG	7 containers of wtp media in parking area.	Annie oil change(her oil pressure dropped .35 bar in last week, .12 bar in last day - to 3.17 bar). Down 2 hours. Then stopped 10 min to replace plug #17. Mains failure-lock out delayed restarting. Lena tripped twice on leanox - down 1 hour total. Made leak worse by trying to improve it.
31-août-21	mar	MO, SG	Some well adjustments LET RT added all new media (many large white bags) into WTP open tanks.	Oil delivery - ordered 275 gal - got 215 gal. Lena still leaking glycol - fills pail in 14 hours (and loses 0.97 bar pressure)
01-sept-21	mer	LPRG		7:25 pm both engines stop due to Hydro line problems. Down 1.6 hours
02-sept-21	jeu	MO, SG, 2xMDL		6:45 am both engines stop due to Hydro line problems. Hydro also put us in lock-out(RY4A LED on). MDL on site for yearly maintenance check (small list). Unable to work since we were down. Returning Sept 10. Hydro was to come with Rogers to install cel antenna - told them not to since MDL was to be working in elec bldg. Able to start Annie at 10:10 - down 3.5 hours (but still in lock-out. Lena oil change + fixed glycol leak at heater loop. Turbo oil filter again clean - reused. Unable to get electric turbo oil pump to work - no power at 39K3 relay. After running 45 min, misfires started - stopped to change plug#7 (on myPlant curve is yellow so could not see cyl temp fluctuations) When stopped, turbo oil pump did not run. Lena down 6.75 hours total.
03-sept-21	ven	LPRG	LET-N adjustement in morning	Shipped two GEM 5000 for annual service. One from BC, other from R.Pilote. Manny shipped 2k parts.
04-sept-21	sam	LPRG	Adjustments on LET-S 02-02 to 02-05 wells. Work on LET-S affecting wells is now up to about 01-06, so previous wells we have are re-installed. They all seemed like the valves were not at the same position they were previously. Also opened those wells to full for 1 min to rinse and flush.	Total power increased from 1900->2100 kw
05-sept-21	dim	SG, LPRG?	Half of LES grass was cut.	Both engines stop at 07:50 on Leanox exceeded, seems blower #2 stopped first and then engines shut down. The VFD's don't display or have records in alarm history about that event. Flare #1 and #2 during down time. Total down Times: 58mins At 14:52 Lena stopped on Leanox. Deviations start oscilating(±0.03 bar) for 30 min, then shoot up 7 seconds before stop. Down 50 min.
06-sept-21	lun	SG?, MO	Blower 2 runs 4°C hotter than blower 1(using 1 amp more) due to newer muffler design(perf sheet covering inlet and outlet)	0:36 Lena stopped on Leanox. Everything looked OK until 7 seconds before shut-down-bypass dropped and leanox dipped, then shot up. Down 30 min. Cleared flare 1 shed - moved old compressor & BOP heater to shop.
07-sept-21	mar	MO, LPRG, SG		8:05 am blowers stopped on hi inlet vacuum (RT work on LET S wells?) - was running engines in manual mode. Down 1.25 and 2 hours. Lena W vent fan put back in operation (blew 2x20A fuses) then put back in bypass mode. 2k parts arrived(minus 2 turbo oil filters) Container of 22 tall Fe bags arrived - Container had soft, rotten floor. Second rebuilt blower muffler arrived - installed on blower 3. Moved bare elbow to Blower 1. Replaced inlet air filter (24"x24") to BOP PLC room.
08-sept-21	mer	LPRG	Work on LET-S is passed all the wells connected to the engines for now. We should not be affected by wells removal for this step of the project.	13:55 Annie stopped on Leannox during work by Matrec to modify some wells. Down 10 min. I was called in advance by Pat and was on site to help them. Annie water pump leaks a steady stream when stopped. Leak is innexistant while it runs.
09-sept-21	jeu	LPRG	Adjustments in LET-S. Covered wells 01-08, 01-09, 02-10 and 02-05. 01-09 wellhead valve handle is broken (turns free from shaft) and gate was seized up. Was able to turn it with carefully placed pipe wrench on shaft (shaft is teflon so hard to get a good grip on). Mark in Ottawa with Armagh Extox panel for ESA inspection. Heater breaker needs to be changed (25A->16A) and blue insulated Neutral wires covered with white tape.	Annie stop 14:27on Leannox, water pump was not leaking this time during stop. Back on at 15:07.
10-sept-21	ven	SG, MDL(x2)		MDL arrive at 8:20 to do Hydro-Quebec certification, they leave at 10:15. Annie was stop before the 8:30 both engines stopped by MDL (Gen Prot Trip) Down 1.5 hours 10:47 Lena down 6 min on ground fault (2116 Dump rad failure) 15:31 both down on Leanox. Down 40 & 55 min. 22:28 Lena down 30 min on Failure Aux.
11-sept-21	sam	SG		0:16 both engines stop on Leanox. Down 0.5 hr Both stop again at 1:51. Hydro unstable(nearby outage) until 11 am - down 9.5 hours. Annie trips on low oil on restart.
12-sept-21	dim			23:57 Annie cyl 4 goes cold. Misfires reach 50% (max 56%)at 1:06am and power reductions begin(up to 6.7%). Misfires drop below 50% at 5:39 and stabilize at 14% at 11am. Also get ignition point reductions (from 20 down to 19.7 for 13 sec max). Lena getting brief power reductions on oil temp whenever dump rad fans reduce to 2, since 1 dump rad fan turned off (failed). Oil temp>90°C

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
13-sept-21	lun	MO	cleaned UPS on cabinet in flare 1 shed (much dust on inlet grate)	Received 2 turbo filters (missing from last order) Stopped Annie for 6 min to change plug#4. Returned vac set point to -74.2"wc (was at -72.0 since when? -with no explanation)
17-sept-21	ven	MO, SG	got 2 calibrated Gem's back from QED.	Media change North tower. Both engines stopped when bleeding tower using flare (flare too high and got hi vac lock-out in BOP. Stopped again after change while purging to air - again high vac (then blower 3 VFD faulted when restarting - high torque). Engines down 35 min total hours total(plus ran low for 1 hour). Lena's 2nd trip was LOE not Leanox. Put brand new blower on top of Lena to swap out #5 during next week's service. Annie keeps getting glycol puddle in middle near outlet dampers - keep cleaning. Blower 3 was put in manual mode and when started, blower 2 stopped and BOP went into lockout again stopping both engines - down 15 min. Lena stopped with "Failure Auxiliaries" when restarted. BOP VFD room door latch totally F'd now - had to enter by large doors at end of container.
18-sept-21	sam	SG		Both engines stop at 5:29 am (leanox) - down 45 min Lena stops again at 21:47 on low glycol pressure. Went from 1.53 to 0.32 bar in 25 hours. - down 1 hour.
20-sept-21	lun	MO		stopped Lena for 12 min to tighten leaking coupler before heat loop hose. Also turned coupling after heater 3 full turns. Installed brand new fan for Lena #5.
21-sept-21	mar	SG, MO		Towers had to be bled. Much smashed Si into filter. Lena down 1.5 hrs. Annie dumped glycol by water pump when stopped - down 1.75 hrs. South Fe tower put first (and last since North tower is isolated) Bought 2nd replacement water counter from Lecomte in St Hyacinthe. Told meter works best horizontally, if used vertically should be with flow upward. We have flow downward. Installed new water counter - worked for a short time then stopped. Put old register (numbers) on new turbine - works. Added water to system and started circulating pump - now giving heat. Annie dropped from (6<->3) to 2 dump rad fans and water temp went from (88<->81) to a steady 80°C.
22-sept-21	mer	MO		Lena's smaller PRV has torn rubber disk inside. Started by replacing reset pick-up (bottom one) and placing at 1 turn out. Total down 22 hours.
23-sept-21	jeu	SG,Hydro-QuebecX2, Cloud Monitored ObjectsX2		Lena stopped at 1:16 am on Leanox dev. Down 36 min - started first try. Hydro and Rogers here to change connection to their meter. Added new antenna on elec bldg. -new phone number to connect.
24-sept-21	ven			1:16am Lena trips on Leanox - down 45 min.
26-sept-21	dim			14:38 Lena trips on Leanox - down 45 mn.
27-sept-21	lun	MO, SG, LPRG, Dom, Matt Bogner(1st time)	LES progressively worse. Now 31% CH4 and 8.2% O2. Put north tower back in operation(second). South tower is first.	Annie stopped at 9:11 for 16k service + coupler inspection and engine allignment. Could not move generator far enough west due to tie down bolts (buggered SW bolt and threaded hole in process). Coupler intact but shows twisting. Measured run-outs. New guy did valves. Dom said we need new shaft seal-DE. Installed 3-way valve(out all summer) and replaced seal in water pump (leaked badly twice when stopped - but not every time) Will have to do breaker closure timing and emissions tomorrow. Restarted Annie at 17:16 - down 8 hours. At 40 min after starting, had power reduction - knocking until air left glycol system and more glycol added. Lena tripped 9:16 (4 min), 10:10(5 min). Stopped for 6 min to change cold plug #4 (tripped on restarting - 1027 Failure Gas train 1) At 17:56, while Annie had power reduction, 2nd blower stopped, killing Lena. Locked engines at 1030kW and left running on 1 blower overnight.
28-sept-21	mar	MO, SG, Dom, Matt	Annie has more knocking since 3-way valve replaced. Sensor #1: 4.23-4.29 mA -> 4.56-4.97 mA Sensor #2: 4.30-4.36 mA -> 4.70-4.98 mA This leads to Ignition Timing Point reductions (from 20 down to 16° CA) whenever 3-way valve position drops from >60%(normal) to below 55% (WTP taking more heat). Also, power reductions - knocking when <33% to dump rads. We go from 6 down to 2 dump rad fans which causes intercooler water temp to rise and thus charge temp rises from 55 to 64°C	Did Annie's emissions adjustment. Said full power setting was ok - slight change to half power setting. Still crashed when ramping from 1030 to 1065 so Dom tweeked values(p2' 3012->3000 mbar(made richer)). Ok after that. Lena's 8k service. First took vibration readings. Matt adjusted valves and changed filters. Dom replaced connector for turbo oil pump relay. Emissions adjusted - again crashed from 1030 to 1065. Changed p2' 3042 -> 3035? mbar. Tried reading breaker closing time but attachment to his Fluke 123 meter blew an A1 panel fuse (63F2 6.25Amp-replaced with 5Amp) which kept the breaker from closing. Will return with proper tool. High vac puts BOP in lock-out twice - 2nd at 18:33
30-sept-21	jeu	SG	Annie was getting power dips (power set current) down to 1030kW with no power reductions present. Causing swings in Leanox (0.3bar)and compressor bypass(30->3%). - was BOP sending lower power requests? Fixed her at 1030kW so BOP had no control.	14:27 Lena stopped with new alarm - down 15 min 13 request module off/on in previous 1/2 hour before stop. 15:21 Lena again "Failure Aux" - down 25 min Old BOP screen briefly showed many "lock-out"s, and XT4's had "request module off/on" at same time. - clearing alarms on BOP screen stopped this?
01-oct-21	ven			At 3pm, Brian Wilson changed Annie's parameters - increasing the number of minimum cooling fans from 2 to 4. At 9:45 am, wtp took heat, but less. 3-way valve only dipped to 48%, kept all 6 rad fans on, charge temp stayed at 55°C, yet knocking still increased and ITP dropped to 18.6 (drops to 18.1 @ 4 fans, 16.9 @ 2 fans). Average exhaust temp rises 17°C when timing delayed from 20° to 16.9°.
03-oct-21	dim	SG		both engines down twice on Leanox. At 13:03 for 1 hour, and at 18:46 for 1.5 & 2 hour. Lena got 1017-Oil pressure low on 1st start attempt. engines stopped twice and restarted unassissted.
04-oct-21	lun	MO	RT work on LET south wells in afternoon. Big improvement in gas in morning - went from 42 to 46% CH4. Yet production did not increase. LES readings that were getting worse for last month was really a leaking GEM hose. Values are good.	At 11:36 Annie stopped on Leanox - had some fluctuations earlier (Lena ran smoothly) - down 5 min Repaired blue shop door latch(would not lock) and keyed alike to office door. Dungs "rush" order for us (smaller PRV repair kit) sat on Victor Silva's desk for 1 week after it was rushed from Europe - he will now rush ship it to us at his expense - 2 day delivery. Took 5 days from overseas - another 8 days from the states.
05-oct-21	mar	MO		Moved oil from FO to day tanks for oil delivery this week. Worked on BOP VFD room door latch(shaft sheared off and spring broken). Looked for supplier for IR communication cable for ION8650 power meter (for monthly data downloads - since modem and phone line removed by Hydro).
06-oct-21	mer			received 6 flare blower belts from McMaster Carr, and smaller engine PRV repair kit from Karl Dungs.
07-oct-21	jeu	SG, 2?xHydro		Hydro on site. Added box under Utapp box to hold power supply and communication card (big padlock on box)

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08-oct-21	ven	SG, LPRG		Cleaned COGEN inlet filter (after PT101) and changed element. No change in diff. pressure drop from before (still around 60mb). One of Lena's batteries has a melted up terminal. Metal has melted and dripped on the top of the battery and clamp does not hold down tight anymore (needs to be replaced). Annie cyl. 9 is colder than others (possibly misfires). Annie stopped on Leannox deviation at 18:21. Changed cyl.9 plug wire and coil one after the other to see wich was the problem. Cylinder was still cold after changing the 3. Also locked all 6 fans on planning on cranking power to 1065kw. There is more power reduction now that the fans are locked, and cyl.9 is not cold anymore. Locked production at 975kw and sometimes it reduces because of power reduction. Water treatment is not taking heat so it could be related.
09-oct-21	sam	LPRG	Adjustments in LET-S. Lots of wells have low points in piping due to removed or poorly installed wood supports. Improved the slope of the engine wells and increased gas supply to engine.	Tightenend leaking union on Lena glycol heater loop. Leak had increased to a drip a second. No drip after tightening. Increased Annie to 1000 kw. Still ignition retard due to knock, but less then yesterday and no power reduction. Cyl.9 is also maintaining temp, aside from a dip mid-day. Other cylinders did not seem to react to it, so it could be the probe.
11-oct-21	lun	MO	WTP takes heat for 1 hour every 2.5 hours Took HV transformer oil sample. - Last done June 25, 2021	Added 10 ltr glycol to Lena (0.65->1.35 bar) - still leaking at hose union just before valve. Increased Annie to 1045 kw and allowed to increase. Stopped at 1060 kW on leanox dev. Down 11 min. On restart, does 45 min of power reduction-knock before 3-way valve opens enough(more water to dump rads) and system stabilizes. Had run 34 hours without any power reductions (but did have timing retards). Stopped again at 16:10 (1030 kW) for 15 min and 16:30 (1000 kW) for 4 min. Left at 950 Kw
12-oct-21	mar	LPRG	LES fall readings started. Did wells 01-16 and 11. 11 has a water wave between the well and the wellhead (puits aval) partially blocking the gas flow. It was closed due to low CH4 for testing. Cracked it so we can evaluate if it's worth digging it up to correct the low point.	On Annie, increased power from 950 to 1000kw and removed the forcing on the 6 fans (they were all on anyways in the afternoon). Leaving water temp of the hot water loop was locked at 100 degrees C(was getting temp spikes on this signal). Went up and wiggled the wires in the probe and gave it small taps. Reading is back to normal.
13-oct-21	mer	SG, MO	Dominic rescheduled service for Friday - still busy at another site	oil delivery - only had 141 of 325 gallons ordered. Received Optical Probe for reading Hydro meter + 4th coupler for Annie. Moved 3rd blower muffler from front garage to BOP blower room. Reassembled BOP VFD room door latch - changed lock to take BOP PLC room key.
14-oct-21	jeu	LPRG, MAB	training of new TT employee on Extox panel and calibration.	MAB shown noise level when 1 blower taken over 53 Hz (piping resonance)
15-oct-21	ven	MO	Dominic rescheduled service for later - sick. Got email too late - already driving from Mtl.	Used new optical cable to download Hydro data from power meter. 10 minutes for 15.5 days. Insulated and covered heat loop pipes at water meter. Lena given 1/2 pail glycol and 1/2 pail oil. Many fruit flies (and house flies) in office trailer.
16-oct-21	sam	SG, MO	Heavy rain - river down road and between flares and engines.	11:55 Lena stops on Leanox dev. Was swinging badly for xx min before stop. Battery terminal had to be fixed before restarting (melted batt post). Down 3:45
17-oct-21	dim		Extox reading of LES CH4 bad (shows 1.4%)	Still running on 1 blower (at 43 Hz) as per SD's request (save electricity).
18-oct-21	lun	MO	Received results on 2nd transformer oil analysis - worse.	9am Lena #5 goes cold (100°C) and starts misfiring. 10 am hits 50% misfires and starts power reductions. Hit 88% misfires and 38% power red. Stop at 12:00 for 20 min to replace plug and tighten batt "+" terminal clamp(broken).
20-oct-21	mer	MO		WTP took less heat from 10 am causing extra knocking and power reductions. Reduced power from 1040 to 1020. At 2 pm stopped on Leanox dev - down 3 min. After increasing from 750 to 1000 kW - power red - knock returned for 2.5 hours, then again when 3-way valve opened more than 50%. Installed blower 1 new outlet muffler - all 3 now installed.
22-oct-21	ven	SG	LET-S Start intervention at 17:00 to 19:00 to correct the slopes, adjust and reconnect on 16'' line some wells for the Cogen. View data in folder Field data.	
24-oct-21	dim	SG, LPRG		Lena stops on Leanox at 7 am. Multiple Control Carb Defective alarms - replaced pot card in gas mixer. Down 3 hours. Lena stopped a second time on 10:53 Gas alarm. Did zero cal. On both high and low levels Gas detectors. Down 1.5 hrs Added a bit of oil to Annie(32 ltr). Was at 1cm.
25-oct-21	lun	MO, LPRG, SG, Dom	Flare 2 would not start on her own. Had to use torch. Propane bottle was empty (was left on "pilot always on"). Not sure we always get ignition spark, or that damper control is working. Once running, had to manually open dampers to avoid running cold.	Dom took vibration readings on Annie then swapped Annie coupler. Oil change at same time and Cyl#9 exh TC wires fixed. Dom took breaker closure time (not sure of results or where to look on XT4 for setting). Down 4.5 hours. Bad power reduction-knock on restart. Found that knock problem started at 16k service (new guy set valves). Left engine at max possible = 800 kW - less when wtp stopped taking heat. Heat and exhaust gas odour at cyl 19, 20. Felt no leaks at heads - split compensator? Dom to return tomorrow morning for hot alignment and check/fix valves. Called Violia for used oil pick-up (UO tank can hold only 200 ltr more). Lena cyl#16 slight exhaust leak.
26-oct-21	mar	MO, LPRG, SG, Dom	Received 5 full propane bottles from RT (serge took empties yesterday). Serge dug ditch and made dirt wall to prevent rain water from entering Cogen area. Manitoulin picked up 4th failed coupling to take to Mississauga.	Dom checked hot allignment - no adjustment needed. Reset all valves - almost eliminating knocking problem. Knocks were below 4.4 before 16k service, now sensor 1 has spikes up to 5.3, but timing fairly stable at 20°. Sensor 1 has a 27 minute cycle where she goes from steady(±0.08 mA) to spiky (±0.35 mA) - with spikes 45.5 seconds apart. Removed B bank exhaust cover and tightened all bolts. Compensators look good. Still a gas smell near #20 and extra heat - can't find source. Down 2.4 hours. At 12:05 Lena stopped on Leanox Dev. Down 7 min.
27-oct-21	mer			
28-oct-21	jeu		Veolia came unannounced for used oil pick-up. Had arranged for a 1 hour notice call. No-one on site.	
29-oct-21	ven	MO, LPRG, SG	Fe shipment in port, but "referred for exam by CBSA" 1st time after 47 containers received. CBSA = Canadian Border Services Agency ?	2:12 am and 4:20 am Lena stopped on Leanox Dev.Down 1.25 hrs and 2 min. Ran next 9.5 hours at 700 kw (unstable above that). At 2pm started Lena oil change + re-piped 1" glycol line at heater (fixing bad leak). Replaced leaking o-ring on 1" oil pipe over oil filters. Rebuilt smaller gas line PRV using all parts in rebuild kit + made new plastic bushing for top plate (old was worn and maybe causing sticking). Shoe-goo repair of torn rubber disk was still holding. Rebuilt starter battery "+" post using molten lead. Down 5 hours.
30-oct-21	sam	LPRG	Vaccum at COGEN around -55 ''Wc. Transferred LET-S wells back to T3. BH-02-01, 01-03, 03-03 and 01-04 back to 12 inch line. They all had high H2S (3600 to 5000). We now have 01-02, 02-02, 02-03, 02-04, 02-05, 01-08, 01-09 and 02-10 on engines.	
31-oct-21	dim			Annie knock sensor 1 has spikes up to 5.86 ma - timing drops to 19.4° Leanox dev up to ±0.192 bar, compressor bypass down to 7% 10:20 pm engines went offline and could not connect to desktop - but could to RT IPC.
01-nov-21	lun	MO		Received 6 boxes from Wika for Armaugh. Ordered ground fault relay, transformer oil test kit. Leak at water meter top flange - added "C" clamps - needs split ring. Took Hydro meter readings - Got warning messages: "voltage & current readings suspect", "timezone not selected properly", "clock may require timesync"
02-nov-21	mar			Received transformer oil sample kit
03-nov-21	mer	MO, Duane	Duane (DA Lube) 1st visit since Covid. Said we can use HardBase 8 oil which other Jenbacher engines run on (out of warranty) which would give longer run times since starting at TBN 8 instead of 5. But would give more ash. Also gave contact info on oil analysis company that Waste Management uses. Half the cost and uses higher limits.	Did 3rd oil sample of power transformer. Oil temp was lower and pressure just slightly positive. Purged a full 2 liters this time (did less last time). 16:38 BOP fan2 reached 500 hours and fan1 faulted stopping blower and both engines. New PLC clock was over 1 hour behind - reset. Lena had to start at 45% gas mixer. (New mixer card installed OK?). Both engines ramped up without problem (Annie still has more leanox dev when going over 1MW)
07-nov-21	dim		D.S.T. ends (clocks turn back)	

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
08-nov-21	lun	MO	Water counter was not spinning - replaced with new unit (which was not working when first installed)	BOP PLC1 panel fan noisy. BOP VFD room emerg lights on - went off automatically later. Lena elec room heater on. Fe container finally cleared - $1362 charge for inspection + $900 steamship demurrage, final free day at port is tomorrow - will get MGT trucker to pull tomorrow ($125)and deliver Wed. if we can get forklift (none in Granby, Cowansville looking). Media change will then be Thurs.
09-nov-21	mar		RT problem with flare 3. Run flare 2 (not flare 1) from 12:00 to 13:40 @600 m3/hr.	14:06 & 14:17 Annie compressor bypass dropped to 0 % and Leanox dev up to 0.254 bar - but kept running.
10-nov-21	mer	MO, SG	Bought RS 485 to RJ45 ethernet converter for Hydro meter. Ran network cable from Hydro panel to Annie A1 panel (overground). Received 2 compressor belts, long RJ45 cable, small bolts.	Forklift only delivered at 12:00 (asked for 11:00). Came from Cowansville. Forgot trans-palatte which only came at 13:45. Fe container delivery postponed until tomorrow morning - truck problems.
11-nov-21	jeu	MO, SG, LPRG		At 6:38 am Annie stopped and went into lock-out (poor Hydro balance) - down 2.5 hours. Tripped on high water temp after restart (valves to rads wre closed). Flare 1 blower would not turn - used pipewrench to start. Flare then startred easily. Heat trace was turned on but not heating. Flare 2 was running cold - had to open flaps. Fe shipment came 1 hour early (scheduled for 10 am when roll off containers were to be swapped. Pushed back container swap to 11:30 (came at 12:45) . Changed south tower. Took 3 hours to fill 13 bags (17:30-20:30)
12-nov-21	ven	LPRG		Leak at water meter flanges on heat exchanger line. Tied down bolts. Running both flares since 1PM to compensate for Lena down. Flare 2 is not quite enough to compensate due to high CH4 levels. Received GF relay from MDL(for Annie). Forklift picked up.
15-nov-21	lun	MO	CAP Excavation work in LET to reconnect collector line "D". At 10:37 am they closed a valve reducing our gas supply and putting BOP in lock-out (High Vac). Removed 8 cups of water from bathroom drain vent line (outside 4" elbow faces upward with no cover)	10:37 Annie stopped on Leanox dev (all blowers stopped due to high vac). Tried starting blower 1 - alarmed on "7902 Drv: Motor stalled". Stopped flare 1, then flare 2 since lack of gas causing high vacuum. Flare 2 showed running at 20 m3/hr with burner pressure of 3 mBar (PT or flow meter incorrect since 3 mbar should happen at 200 m3/hr). Ordered a couple missing parts for Lena cyl#16 swap - Kyle OConnor to drive tomorrow morning - on site around noon.
16-nov-21	mar	MO, SG, Kyle Oconnor	used flare 2 when Annie stopped - took a couple start attempts before pilot would light. Went to blower 1 - faulted again on "motor stalled", but worked on 2nd attempt. Have to check for leaks at flange - slight gas odour in blower container. RT work at WTP - many contractors working late. Pulled air pump from basin, transferred pond sediment to teabags, + ??? Started heater in shop. 1st snow flurries	Removed Lena's exhaust covers and bolted angle bar to exhaust manifold. Kyle's 1st time at Cogen. From Calgary - comes east for Joe. Will go to Biomont after us (had done a 30k for them). Used his better boroscope (flexing head) to see piston top and valves - exhaust valve not closing totally. Exh valve retainer also cupped. 17:13 Annie down on Hydro trip - went into lock-out due to unbalanced bus bar voltages. Down 48 min. Took Lena oil sample using turbo oil pump - had to open 1" line after pump again to get oil to flow. Hydro told us their PT's on power poles were recalled and we have to arrange for their replacement before the end of year (at Hydro's expense).
17-nov-21	mer	MO, SG, KO		6:42 am Annie stopped on Hydro trip. At 6:54 she attemps 3 restarts and trips on start-up failure. Restarted at 7:09 - down 27 min total. Removed 2 glycol pipes, then head. Piston had been hitting exh valve which remains open a bit.
22-nov-21	lun	MO	RT still filling teabags - very full. Light on side of flare shed 1 not working. Light at BOP PLC room door not on steadily.	Left towers with South tower(fresh Fe) first. Will change direction when it starts passing H2S. This way North tower is well rejuvinated before it sees full load. Will switch again when North tower starts passing - will see if this extends Fe life. Emails to Jetcare about possible problem with power transformer (after viewing 3rd oil analysis). Transformer oil now in slight vacuum - will be unable to take further oil samples.(later shown that vacuum can be released - adding air above oil)
26-nov-21	ven	SG, ?P	? Pilote came to adjust LES wells. GEM internal filter plugged. Left his filter behind.	7:07 am Annie XT4 stops displaying and recording data (and counters don't change). This is the 3rd? occurance. You can connect remotely, but not see any values. 11:32 pm Lena stops on low oil level. Then fails safety valve test. Down 1.25 hrs Day tank emptied + 2 pails taken from Annie's day tank. Joe and Stephen exchanges over invoice charges for techs coming from Mississauga vs St Julie as promissed by Frederic Lebel.
28-nov-21	dim	LPRG	Flare 2 would not start on her own. Had to use torch. Problem with HV transformer on pilot? Flare 1 blower VFD faulted and blower would not start - yet heat trace was on. (last time there was no heat so blower was frozen - needed pipe wrench to "crack" her to turn). BOP PLC room emerg light was on.	Both engines down on Leannox at 8:04 AM. Only received alarms from Lena. Annie screen had no values on arrival (we don't get alarms when it happens). Reset Annie XT4 (was frozen for 50 hours). Both engines had mains failure alarms and one got active during restart attemps. Needed to add oil to both engines. Was able to restart after waiting for mains failure to time out. Down 1.4 & 1.6 hrs. Problems with BOP after restart. Some of the values would jump around a lot, including CH4, FLOW, PT 111, TEMP. OUT H2S, and the water loop sensors. Would cause the blower speed to be all over the place since PT 111 is the engine feed pressure. Lasted about an hour and then just went away while i was looking at BOP drawings.(actually, readings fluctuations could be cause of stop and values fluctuated off and on throughout stoppage and restart). Swapped H2S towers position wich was not done after last media change. Filled up and restarted water loop.
29-nov-21	lun	MO	Etienne? came to return the propane flare starter. He said "flare 3 had issues in the past 2 weeks" Attached actuator back onto inlet air flaps in flare 1 shed and blocked large air inlet. Reset flare 1 blower VFD - blower started with no problem.	Annie power output shows spikes from 10:55 to 13:20. Gas quality swinging from 38 to 43% CH4 throughout day.
30-nov-21	mar	MO, SG, 4x MDL, Rino Dumont	Ran both flares during down time. Flare 2 needed torch ignition. Flare 1 no problem. Opened 3rd pit and tightened all flange bolts. Worst leak was 2 threaded hose connections. Took full tank of water to fill water loop. Replaced Annie's ground fault relay - but it is still bypassed. Annie's inlet dampers never closed. Lena's closed, but didn't fully open when trying to start, so got alarm "1129: Failure Auxiliaries". Also keep getting "failure gas train 1". Emptied FO tank into day tanks to prepare for tomorrow's oil delivery. Went back to blower #1. - took 3 attempts to start. Amps would rise sharply and fault without turning.	MDL work on power transformer. Opened the main braker and tried to rack it out(too close to floor to use crank). Opened switch on middle power pole. Disconnected all transformer connections - primary and secondary. Opened top cover and drained 3/4 of the oil. Measured resistance, played with tap switch and said resistance went down - poor connections. Said that they should have seen more carbon build-up on switch contacts if that was the problem. Bypassed tap switch (connected wires together directly). took oil samples before and after all work and left a test kit for us to take another in 2 weeks. Filtered oil when pumping back and added 40 liters (2 pails). Closed top cover and pressurized system for leakage test. During shut-down, and 2 hours after restarting (for 1 hour) had fluctuating readings like last Sunday. PT111 fluctuations caused the blower to ramp up and down wildly. During shut-down, Innio was going to connect remotely to download latest software into Annie's XT4. An attempt to stop her display from freezing (no data displayed or recorded, and her counters not changing). We had 4 such occurances - lasting days - until she is stopped and rebooted. Lena had 6 occurances but each lasted only 10 to 60 seconds - returning to normal without intervention. Innio to do this at next services. Total down time - 10 hours (8:00 - 17:33,18:04)
01-déc-21	mer	MO	Since long shut down, could not power up Novatech analyser with its heat trace - kept tripping breaker in PLC panel. Ran last night without the heat trace. Today, stopped analyser and ran only heat trace - took long time to go from -2° to 36°C. Was then able to start analyser with heat trace still on. With analyser off, PLC shows 25% CH4	Oil delivery of 650 Gal. Came to us first instead of Biomont to ensure we get full delivery. Gas quality dropping. Running on 1 blower became too noisy as it was running at 51.9 Hz.Took sound level readings on 1, then 2 blowers. Also power to Hydro (at 2130 prod) 14:18, when starting second blower, we went into lock-out(high vac) since the 2nd came in without the first slowing in time (outlet pressure also got high). Lena was able to start herself on auto. On 2nd attempt at starting 2nd blower, only Annie tripped. Total down time <15 min.

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
02-déc-21	jeu		From 18:30 yesterday to 3:00 am, field vacuum and blower frequency fluctuating with 7 minute period (water in pipes?). Freq 29-31 Hz. At 11 am CH4 jumps 42% -> 45% At 12:30 pm, WTP abruptly stops taking heat (swapping heat exchanger) and Annie water temp climbs 82.4° -> 94.8°C causing power reduction for 2 minutes - down to 950 kW (10.8% red). At 14:50 water added to loop and heating resumes.	
03-déc-21	ven			7:49 am Annie's knocking decreases (Sensor 1: 4.5-4.62 -> 4.38-4.55, sensor 2: 4.25-4.28 -> 4.1-4.18) 9:00 am Annie water pressure starts to rise (1.09-1.36 -> 1.6-1.93 Bar)
04-déc-21	sam	LPRG	Some south side LET wells frozen. BH-02-03 blocked completely. BH-02-04 was also blocked, but ice drained after opening the valve. Heavy leachate flow for several minutes after opening. Some wells on the 12 inch line also frozen and leaking leachate ''popsicles''.	Lended our spare flare ignition transformer to M-A.Brouillard to allow diagnistic of St-Rosaire flare (one of his clients). He is supposed to bring it back after diagnostic, unless a dealer has it in stock and can ship it to us this week. 13:51 Annie gives high water pressure warning (2.0 Bar) - stops at 2.2 bar. Pressure rose 0.5 bar in 36 hours. Exchanged texts with Brian Wilson who said we may have "sparkplug carriers may be allowing combustion into the glycol system". Air bleed valves at dump rads should allow these gasses to escape - to check
05-déc-21	dim	LPRG		Swapped Annie's 2 left dump rad bleed valves. Replaced lower right bleed valve with old unit from storage.
06-déc-21	lun	SG	snow last night, mild weather today. 1 south well ? given back to flare 3 ?	At 12:00, Lena Leanox dev increasing(to ±0.126 bar). 14:49 bypass drops to 0 , leanox dev rises to 0.475 bar, and stops engine. 4 more trips while ramping up over 1030 kw. Down 3 hours. Since 5pm yesterday, Annie water pressure increasing at 0.2 bar per day. Later decreases. At 18:40 Annie almost stops. Set power reduces to 1035 for 10 sec with no power reductions shown. Then Leanox dev jumps to 0.218 bar and compressor bypass falls to 1% - all clears after 10 seconds.
07-déc-21	mar	MO	Etienne? Came to borrow the flare starter propane stick - said flare 3 still has problems.	Manitoulin delivered parts for 2k services - did not include extra parts ordered (head, valves, rocker arms, etc). Installed antenna for cel signal booster. Pointed at Granby (3 towers there).
08-déc-21	mer		3:22 am a well unfroze? Went from -2.64 to -2.49 vacuum and production climbed +165 kw. 15:00 wtp added water to loop 10 -> 19psi	
09-déc-21	jeu			
10-déc-21	ven			
11-déc-21	sam	LPRG	Transferred BH-01-08-S from engines to flare 3.	At 6:45 Annie cyl#1 goes cold for 17 minutes. Misfires drop production to 850 kW. Knock sensor 2 increases from 4.2 to 5.0 mA and misfires go to 70%. Power red misfire up to 20%. Lena has slight power fluctuations at same time. At 12:52 for 5 minutes, 13:45 for 25 minutes, 13:45 for 25 min, 14:34 for 84 min, and 16:06 for 14 min until power was reduced, Annie exhaust temps rise 5°C, Leanox dev swings ±0.2 bar, compressor bypass from 0 to 44%, power ±40kw. Lena stable. Lena stopped at 15:47 on Leannox deviation. Down 32 min. High CH4 affecting engines. Annie Leannox and bypass were all over the place. Reduced her to 1000kw and it stabilized. After restart, removed a well on the south side and kept running flare 1 with manual bypass opened to reduce CH4 content and avoid further stoppages.
13-déc-21	lun	MO	Cut out fencing in front of BOP and installed gates - used existing narrow posts - needs new posts installed (should also put them in front of trailer for 3rd engine). Tried Guardian analyser from purchased St Raymond flare. Shows "Err" and flashing red LED's, no CH4 reading.	Cogen down on Hydro-Quebec power outages caused by strong winds. No e Novatech was running without its heat trace since both on trips breaker if traced line needs a lot of heat. Stopped analyser and ran tracing for 4.7 hours, then turned on analyser. When analyser is off, reads ~25% CH4. When calibrating, reads 0.1%. Took 16 minutes to get good readings back. Received Xmas fruit cake from Hego.
14-déc-21	mar	MO, LPRG	Moved items closer to shop container - clearing area allowing for passage into cogen around back. Well ??? taken back to engines.	Took transformer oil sample and sent to MDL. 14:03 Annie cyl 1 went cold again - reduced, and locked at 1030 kW.
15-déc-21	mer	SG		Replaced Annie spark plug #1 received Enerflex shipment - spare parts including new head, and parts to rebuild a head + 2 auto-bleeders for dump rads.
16-déc-21	jeu			Received new coupler from Enerflex (5th)
18-déc-21	sam	SG	Add well on Engines 3:45am BH-02-06-S 57% CH4, 0.3% O2, -13mbar H2S over 1000	Both Engines down on Lock-Out old BOP at 02:51 to 03:29 Flare#1 during that time at 100% Put back permission ready and clearing alarms on Engines No other alarm to clear Add water on Heat exchanger system Down time Total: 38 mins
20-déc-21	lun	MO, LPRG, Rino	Flare 2 would not start. Milot brothers came to borrow propane torch to start flare 3 at 4 pm. Sample line for LES was frozen - read 2% CH4. Heat trace was tripped (panel P-1, #20 or #26) Also tripped was panel P-2, #2&4 (BOP). Again received Bell bills for canceled services (GE modem + static IP)	Annie oil pressure dropped 0.45 bar in 7 days - will stop on low oil pressure(3.0 bar) in 2 days. 7:57 am both engines stop on Leanox deviation - down 1/2 hour. BOP starts fluctuating readings and blower Hz, and both engines stop again at 9:31. Old BOP panel had tripped breaker DCB1 providing 24v to PLC AD module. Engines down 1/2 hour. Had to add water to heated loop in WTP to start giving heat. Fluctuations again briefly at 11 am. Put new coupler in elec bldg (was outside 4 days). New design includes new hub for generator shaft. Cleaned sp plugs - need to be gapped. Greased Lena generator bearings. Annie due in 2 weeks (still 2+ tubes of grease left).
21-déc-21	mar	MO, SG	cleared 4" snow During the night, transfered well BH-02-06-S back to 12 inch line to reduce CH4 level.	installed cel booster antenna on new bracket on top of BOP. Lena stopped on Leannox at 23:23. Down 45 min. Stopped again during ramp-up for 3 min. Made a well transfert to reduce CH4%, she was not able to stay stable over 1000Kw/h
22-déc-21	mer	LPRG, DOM, SG		Lena had frequent knocks , and a power reduction-misfire. She was stopped at 3:58 AM for 10 minutes to change spark plug on cylinder#12 . 18K service on Annie. Inspected coupler. 6 inch long tear (crack in rubber). Cannot install new coupler because hub and spacer are different and Dom does not have the tools required to change it. Soonest tools and 2 tech can be on site is around mid jan. Ordered and ''old'' model coupler. Enerflex would not sell it to us unless we sign a waiver of responsability in case of damages or accelerétad wear. Innio does not allow the to install the ''old'' type coupler on our 2 engines, but only our engines, no directives for other engines of the fleet. Accepted the waiver and coupler is hotshot to us tonight. Dom did the 2K, changed the seals on the intake throttle shaft. Will not be able to adjust emissions because he dropped is laptop during work and it's not working anymore. Will check his old laptop tonight. Changed oil and filters. Also not able to install XT4 update.

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
23-déc-21	jeu	SG, LPRG	Transferred BH-02-06-S from Flare#3 to Engines at 05:00am.	The converter is in office, I transfert all the goodies needed to play with it on computer desk name file Converter_RS485. Let me know when you wanna install, I will do it with you and show you how it's work. Coupler came in last night, but hotshot was using office phone number to reach us so we never got the call. He ended up calling Pat Milot and Julien came to unload the pallet and delivered it to the COGEN this morning. Stopped Annie around 7:30 AM to replace coupler. Called Veolia to set up a used oil pickup. Restarted Annie after cold alignment. Vibration levels have reduced a lot. Started on Lena 2k service and oil change. Doing XT4 upgrade on both engines. Hot alignment on Annie after Lena 2K service and update. Tried to adjust emissions, ended up enriching Annie a little bit. Lena responded badly to changes. Nox were a bit high so we reduced gas mixer set point and engine started reacting violently to increases in power (leannox would go positive and turbo bypass would close completely). Put it back to previous values and engine ramp up stabilized. Dom suspects there may be an issue with the bypass actuator, but unsure.
24-déc-21	ven	SG, LPRG	At night, LET-S adjustments to increase production. Later in the day, transferred BH-02-06-S back to 12 inch line because temperature was warming up and CH4 content increasing. Assisted Pat Milot in starting flare 3. Bugged universal transmiter for flaps position had to be reset and pilot line frozen.	At night, both engines stopped after Blower room ventilation stopped. Lena stopped around 12:30 PM on Leanox dev. Replaced plug no.2 that had misfires. Engine is smoother after that. Added water to the heat loop and to the old plant water tank. Fixed small leak at water meter by tightening bolts.
25-déc-21	sam	LPRG	Opened manual bypass between flares and COGEN and started flare 1 to increase vacuum on the field and reduce CH4 levels at 14h30.	Annie having Leanox spikes due to high CH4 levels. Filled up old water treatment shed water tank. Increased blower room heater thermostat to 20 degrees.
28-déc-21	mar	LPRG		At 1:00 PM, bucket at Annie's oil leak was 1/3 full. Sucked most of it back in the engine. Topped off water loop pressure (13 to 24 psi). Lena stopped at 6:40 PM on 3025 ignition trigger pickup missing. Cleaned both pick up. Minimal metal filings on the bottom one. On restart, engine shut down violently when switching on the sychronization switch. Engines goes down on alarm 2688 - current too high during sychronization. Also trips the overload short circuit. Breaker tries to close about 1 second after switch is put on auto, no matter the current phase angle. Noticed multiple tears and a small piece missing on the coupler after the violent stops. Tried a full reset with no change to the issue. Tried synch one last time slowly adjusting the gas mixer to try and have the phase angle hover around 0. Was able to get it and 1 second after the sychronization switch was put to auto, engine synched softly.
29-déc-21	mer	SG	**Transferred** BH-01-08-S and BH-03-07-S from 16'' to 12'' at 08:45 BH-02-06-S from 12'' to 16'' at 15:20	Annie stop on Leanox at 05:47am, having Leanox spikes due to high CH4 levels. Back at 08:12am. Oil dropping stable, bucket 1/3. Nicolas is on the mission to added water for heat exchanger. Flare#1 on when down time Down times totals: 140 mins(Annie)
30-déc-21	jeu	SG, LPRG	Transferred BH-02-06-S and BH-03-07-S back to 12 inch line and shutdown flare 1.	Annie down on Leanox deviation at 9:22 AM. Restarted at 9:56. Filled up hot water loop. Annie stopped again early afternoon and around 10:30PM. Leanox is unstable in cycles, especially above 1050 kw. Restarted her at 11:00 PM and went around to check SP wires. Cyl. 15 wire has a loose connection to plug and creates misfires when slightly touched. Replaced it plus SP. Leanox seems better after the change and for now i see no little power spikes. Annie in manual. Closed Lena glycol heating loop valves and breakers. Hose shakes a lot, probably due to bad coupler. At first, closed breaker for the charge water pump by mistake and caused Lena to stop.
03-janv-22	lun	MO, LPRG	At 8:45 WTP stopped taking heat for 8 hours.	9am Annie starts misfiring. At 1051 misfires = 50% and power reduction begins. 13:55 stop Annie for 20 min to replace plug #3 and wrap rubber tape on small leaking pipe - stopping oil leak. Suck full bucket of oil back into engine and clean floor properly and completely.
04-janv-22	mar	SG	GFL working on LET-S wells to fix well head	Both engines stop Lena at 02:31 and Annie 02:45 - no emails from Lena - our myPlant "full professional level access" has expired (Annie's will expire May 12, 2022) Lena on Leanox deviation Annie on Main Failure, change spark plug on cyl#6 after first start has failed to ramp her up over 1044Kw. No vacuum on site 02:45 to 07:15 so transfer to Flare. Flare#1 failed to start, blower stock (GFL need to fix it) Flare#2 on 07:15 to 08:45 Total down time: 300 minutes
05-janv-22	mer	SG, Guilbault	Matrec continue to working on LET-S wells improvement	Delivery by Guilbault transport at 11:05 of 3 transformer from Hydro-Quebec to the replacement work on next Tuesday by MDL Order forklift and pallet jack from Loutec(PO#535) for tomorrow around 8:30am
06-janv-22	jeu	MO, SG		2 containers (44 bags) of Fe delivered. Due 10 and 11 am, arrived 9:30(picked yesterday), 13:50(had to be paid before release). Forklift dropped off before 9:30, picked up tomorrow morning.
07-janv-22	ven			Veolia emptied used oil tank- 2071 ltrs.
09-janv-22	dim	SG, LPRG		Annie stopped twice on Leannox. On second stop, went around and check all spark plug wires at full power. No spikes, but got a shok on wire no. 4. Probably not the cause of the Leannox stops so let the engine run. Put Annie in manual at 1030kw to avoid further stoppages during the night and resume diagnostic tomorrow. Water treatment not taking heat presently. 3 way valve stuck in manual at 0%. Informed GFL. Lena stopped on low oil. Added oil and restarted.
10-janv-22	lun	MO	GFL came to repair flares 1 & 2.	Manlift delivered for Hydro use tomorrow. MDL will bring a basket truck. Brown pick-up truck needed boost to start. Cleaned trailer water pump inlet filter - water at sink was black and smelly. Problem sending emails from laptop after lunch (worked in morning). Put Lena in manual mode in case she stops and restarts herself (syncing at random phase angle). Annie already in manual mode to lock her at 1030 kw (unstable Leanox).
11-janv-22	mar	MO, LPRG, MDL, Hydro	Got gas heater gun working by replacing 2 fuel hoses. (15" +8" x 1/4" id, 3/8" od)	PT's on Hydro pole (to measure production) changed by MDL (paid by Hydro since it was a recall necessitating the change). Hydro made the low voltage connection and reprogramming of their meter? MDL also replaced 3 cracked insulators on fuse holders (our cost-$4000). New tran oil samples taken by MDL for rush analysis. After rebooting, Annie's green ring on sync phase dial disappeared and normal sync took place (took 4 seconds). But ring reappeared and could not be cleared, and next sync was instant (0.3 seconds). Lena starter battery weak after down all day - voltage dropped to 8v when cranking. Could not add actually water to get WTP heated loop functioning.
15-janv-22	sam	LPRG, SG		Both engines stop on mains failure at 3:00 AM and later at 16:50 and 20:20. In the morning, Mains trip would not clear until about 7:00 AM, but it was shorter in the evening. Longest process is to fill the hot water loop. Suspect a leak.
16-janv-22	dim	LPRG		Both engines stopped on mains failure at 6:20 AM (Mains did not trip). Restarted both around 11:30 AM. Gaz quality fluctuations in the first 15 minutes after restart. Annie does not have a green circle on the synchronization screen when idling or once synched and sychronizations works the intended way with proper phase angle and delay. Filling hot pipe with water truck directly on system, above water treatment heat exchanger. It took about 15 min to pressurize the system and get some heat.
17-janv-22	lun	MO		Lena oil level gage support bolt broken (might be vibration)

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
18-janv-22	mar	MO, SG		Thursday media change - broke 2 shear pins. Hydro UPS not working (was beeping on day Hydro and MDL changed pole transformers).
				Drastic reduction in gas quality - reduced engines to 1600 kw, yet CH4 dropped to 32%. Adjusment need to be done on gas fieild by GFL.
20-janv-22	jeu	MO, SG, LPRG	Hydro came to replace UPS in their meter cabinet. Another came to take the 3 replaced line transformers.	Media change North tower. Containers had 12" snow so tower not emptied. Added media without using sock(1st time). Tape measure broke. Greased Annie gen bearings. GFL Patche air leaks in north wellheads.
21-janv-22	ven	LPRG, SG	Flare#3 still stop in maintenance, they are not able to start	
22-janv-22	sam	LPRG, SG		Both engines stopped at 7:30 AM on Leannox deviation. Still possible multiple air leaks in the field caused the shutdown. Engines were in and out of mains failure until 9:45. Started and ramped engine between 9:50 and 10:45. Added water to the water loop. There seems to be a leak in the ground where the pipes pass under the COGEN fence on their way to the first pit. Snow is melted in a large area and mud made it's way on top of the rocks. Changed flare 2 spark transformer (GFL). Now sparks. Spent couple hours in the field fixing numerous air leaks on the north and south side. We went from 37% CH4. since last repairs, we climbed to 41,7% CH4. Repairs caused both engines to go down for about 15 minutes at 16:05. Engines stopped again at 18:39. Lena bad plug on cyl 9 caused her to stop when ramping up. Replaced Lena cyl.9 plug, but mains failure until 20:16 prevented startup. Filled water loop easily because i kept it running without heat demand during the stop, but after i left pressure stedily decreased until next morning.
23-janv-22	dim	LPRG		Pressure drop in hot water line caused pump to stop around 9:30 AM. Raced to site to fill system back up and prevent contraction cycle to reopen in ground leaks. Was able to pressurize the system in 30 minutes, and pressure seems to maintain better then last night. dropped 1 psi in 3 hours. Novatech readings are under evaluated. Reads around 43% CH4, but present GEM readings are 46 % CH4 and 2% O2.
24-janv-22	lun	MO, LPRG		
25-janv-22	mar	MO, LPRG, Rick Bill, MAB, >5 contractors (vac truck, cement truck, gravel truck, small excavator, work trucks+trailers)	Water/vac truck used to excavate down to leaking 4" water line (at fence line SW of south Fe tower. Leaking joint cut out and piece of pipe added with 2 clamps. Checked bladder tanks at WTP - correct at 15 psi pre-charge. Tightened back left expansion hose threaded fitting at flange in pit 3 on heated water line. Right front still has slow leak.	Annie synced multiple times with scope attached to measure closure. Same done on Lena, but with wire removed so relay did not get closure signal. 6.5 amp fuse 11F2 blown while connecting probe (temporarily replaced by 10 A). Compressor belts changed. Oil transferred to day tanks for tomorrow's oil delivery (475gal = 1798 ltr)
26-janv-22	mer	MO, LPRG, RB, 2x contractors	2nd water loop pipe opened where small leak was starting at connection and new clamp installed. To return tomorrow to fill pit with weak concrete and gravel (concrete truck not available today). At 17:30 inspected LET: BH-01-08N had 4" fernco slipped off and leak at 8" Victaulic - tightened 2 nuts 1/2 turn. Also Vic on BH-01-03N. On south side, BH-01-08S has a union on engine side of 'T' that is pulling apart and leaking slightly.	Multi Measuring Unit (PLC block - upper left in A1 panels) swapped between 2 engines. Now Annie syncs instantly when sync switch put to auto. Adjustments made to both Mains Monitoring Device (on left door of A1 panel). Now proper line voltages are seen,and mains failure that locks us out is less likely. Top line at heat tightened 4 saddles clamp nuts 1 turn each. Chris Betts(Innio) logged into Annie to clear power reductions. Oil delivery 445 gal instead of ordered 475 gal.
		SG		
27-janv-22	jeu			1 engine off
28-janv-22	ven			1 engine off
30-janv-22	dim	LPRG	Fixed minor leaks to atmosphere on LET-N.	Novatech frozen.
31-janv-22	lun	MO, LPRG	Checked LES wells - have 7% O2 - Leak somewhere Checked LET - transferred BH-01-04-S from flares to engines.	Worked on generator
01-févr-22	mar	MO, LPRG	Workers try to thaw 2 wells on South side on GFL . Used gas heater and power converter off truck battery.	
02-févr-22	mer	LPRG	RT thawing wells on south LET.	Lena briefly stopped to change #7 sp plug (was in power reductions for misfiring since midnight).
03-févr-22	jeu	SG		Annie Cyl #1 goes cold at 16:09 and misfires start. At 17:50 power reductions begin. Stopped at 19:56 for 7 minutes to replace plug. At 23:17 Cyl #3 starts missing and Annie get spikes on power and leanox, but cyl never goes completely cold - no misfires
04-févr-22	ven	SG		Annie cyl #4 goes cold at 3:40 and starts misfiring. Stopped at 16:34 for 7 min to change plug #4. Plug #3 still bad
05-févr-22	sam	LPRG		Annie starts misfiring at 3:34 and power reductions from 4:17 Stopped at 10:14 for 10 min to change plug #3.
06-févr-22	dim	LPRG	Flare#3 stopped yesterday at 11 AM.	Lena unstable. Reduced yesterday to between 1000 and 1050 kw. Reduced further today in the evening to 950 kw. Field has to be adjusted. Increasing T2 but still some unstability at 46% CH4 (way less then before intervention in the field).
07-févr-22	lun	MO		Serge delivered 3 barrels of glycol
08-févr-22	mar	MO	Adjusted some fence gates to make opening easier. Manny still unable to give dates for MMU and 2nd coupler supply. Also asked him for more PT's (6 in stock are 150VA - need only 60VA.	Lena stopped on Leanox deviation at 13:08. Down 5 minutes. Finally found problem was loose connector on gas bypass valve. After fix, Lena running 23C cooler (was running too rich) Cyl 8 gave problems(went cold) during ramp-up. Green circle stays on on sync dial (as it had on Annie before swapping MMU's)
09-févr-22	mer			
10-févr-22	jeu	LPRG		searched for supplier for PT's for L1 panels. Got quote for $159 vs $364 from Enerflex - but still 8 week delivery.
11-févr-22	ven	LPRG, MDL		MDL came to take oil sample from large transformer - sent for analysis.
12-févr-22	sam		large ambient temperature drop. CH4 started dropping at 13:30 (42% -> 38%) and vacuum increased.	17:00 Lena starts misfiring (up to 25%) - cyl 7 going cold.
13-févr-22	dim	SG		Around 4 am lose internet - again no e-mails sent telling of lost connection. wIggled wires at switch in office to restore connection at 10:45 - get "online" emails from both engines.
14-févr-22	lun	MO, LPRG	Found connection problem due to weak 1' long cable between switch and modem. Cable from flare #1 IPC also has loose connector.	Lena power reductions(misfire) since 1:25 - down to 873 kw. Stop her at 2 pm for 33 min to change plugs 7, 8, 14 . Trouble syncing after restart. Finally allowed sync dial to make complete revolution - synced next time she was at 0°.
15-févr-22	mar	MO		Annie cyl#18 causing some power spikes. Prepared for 2 oil changes.
17-févr-22	jeu	MO, SG	Flare 2 would not start until propane tank shut off and reopened -	11:17 **Annie** stopped on leanox dev. Did oil change. Overfilled - removed 2 pails and poured back into FO tanks. Re-applied rubber tape on small leaking oil tube. Also tightened hose going to oil level guage (1/2 turn). Down 3.5 hours. 1 hour after restart, knock sensor 1 noisier (higher freq) and slightly elevated leading to ITP reductions down to 19.3 degrees. Knock sensor 2 actually flatter. At 14:52 stopped **Lena** for oil change. Power reduced all the way to 0 and breaker stayed closed - had to manually command breaker to open. Oil pump would not start (Switch on MC panel door was open). Once emptied, removed Krampitz oil pump outlet check valve to redo thread seal and tighten - stopping leak. Removed bypass cable and cleaned contacts. Reattached oil levet guage to frame by using extra nut over broken bolt. Trouble clearing alarms (E-stop near cyl 5 was pressed). Did 3 panel resets but could not clear green sync circle - would reappear when PLC powered up. Disappeared after running with power. Down 2.3 hr. Used previously failed spark plugs. Had to stop 4 times to swap plugs (4,5,11,6,16,7,1,7) - some simply not gapped. Final running by 19:30.
18-févr-22	ven	SG		Annie stops on leanox dev at 14:18. Down 1 hr. Lena power reductions (down to 960kw) since midnight. Stopped at 15:34 for 41 min to change plug 7. Did panel reset - clearing false power reductions.
20-févr-22	dim	SG		Annie oil leak at little pipe elbow stops her at 23:08 last night. Down 2 hours. Lena stops at 23:10 on Leanox - down 1.25 hours.
21-févr-22	lun	MO, LPRG	CH4 dropping all day. Fixed one leaking Fernco in LET north on good well .	Annie was again leaking oil at small tubing elbow compression fitting (loose nut). Clean-up done.

Date	Jour	Personnel sur les lieux	Description travail outre les engins	Description travail mécanique
23-févr-22	mer	LPRG		On Annie, leak is coming from pipe above oil cooler that goes to filters has a small crack. It was repaired before and cracked in the repaired weld from what i can see. Missfire Lena at 18:09 cyl#20. 18:21 power reductions begin - max down to 775kw. Change spark plug at: 19:08. Also changed cyl 7 plug and wire (plug was good). Wire boot on connection point to coil was torn and took a shock touching it when running. Plug temp was lagging behind on startup and higher than others in normal operation. Cyl 16 also lags behind when ramping up. Total Down Times: 13 min.
24-févr-22	jeu	LPRG		Annie oil pipe leak worse - Oil is collected and suck oil back into engine. At 13:26 Annie cyl#6 temp dips to 487C for less than 1 minute.
25-févr-22	ven	SG		2:21 am Annie stops on low oil. Down 3 hours 2 minutes later Lena stops on Leanox dev - down 1.7 hours Annie stops again on low oil at 21:50 - Lena 3 minutes later on Leanox - down 3.3 hours. Annie restarted 6.5 hours later for 16 minutes, then stops on high oil. Left off until cracked pipe can be welded.
26-févr-22	sam	MO		Lemelin welds cracked pipe over Annie oil cooler (2nd time).Welder there between 11:30 and 14h00. Down 9 hours. Lowered high oil level using oil cooler drain - left valve open during restart, emptying engine oil.
03-mars-22		LPRG		Received 2k parts kit, including new model coupler for upcomming replacement. Prepared 1 defective MMU for shipment and it was picked up by Puro. Clean-up in and around Annie.Slow drip oil leak at oil cooler back top pipe.

Stephanie

28k	29-Nov-15	5 hrs	
30k	20-Feb-16	12 hrs	30k & 32k swap
32k	7-May-16	5 hrs	
34k	29-Jul-16	5 hrs	
36k	9-Nov-16	5 hrs	
38k	31-Jan-17	5 hrs	
40k	24-Apr-17	14 days	40k & 42k swap
42k	31-Jul-17	5 hrs	
44k			
46k			
48k	24-May-18		
50k			
52k			
54k			
56k			
58k			
60k			

Darlene

20k	19-Oct-15	14 days	
22k	24-Jan-16	5 hrs + turbo swap	
24k	6-May-16	5 hrs	
26k	28-Jul-16	5 hrs	
28k	8-Nov-16	5 hrs	28k & 30k swap
30k	30-Jan-17	12 hrs	can run engine overnight
32k	25-Apr-17	5 hrs	
34k	18-Jul-17	5 hrs	
36k			
38k			
40k	23-Apr-18	13 days	
42k			
44k			
46k			
48k			
50k			
52k			

Annie

2k	7-Jan-20		
4k	6-Apr-20		
6k	2-Jul-20		
8k	29-Sep-20		
10k	6-Jan-21		
12k	29-Mar-21		
14k	8-Jul-21		
16k	23-Sep-21		
18k	22-Dec-21		
20k	15-Mar-22		
22k	6-Jun-22		<-major
24k	29-Aug-22		
26k	20-Nov-22		
28k	11-Feb-23		
30k	6-May-23		

Lena

54k	7-Jan-20	
56k	6-Apr-20	
58k	2-Jul-20	
60k	23-Sep-20	
2k	7-Jan-21	
4k	30-Mar-21	
6k	7-Jul-21	
8k	22-Sep-21	
10k	23-Dec-21	
12k	16-Mar-22	
14k	7-Jun-22	
16k	30-Aug-22	
18k	21-Nov-22	
20k	12-Feb-23	
22k	7-May-23	

oil changes	
each 7 week	2 hrs

each 20,000 hours: 14 days + 12 hrs + 8 x 5 hrs = 388 hours of service
+ 17 x 2 hrs = 34 hours of oil changes
so we run a maximum of 20,000-388-34 = 19,578 hours / 20,000 hours = 97.89% up time

2019 Hydro Cuts:

Date	start	end	hours	Reason
04-mars-19	09:00	16:50	7.8	Hydro maintenance work
16-mai-19	09:00	16:00	7.0	Our maintenance on Hydro's request
23-mai-19	20:20	23:25	3.1	Hydro outage
01-sept-19	03:10	05:45	2.6	Outage - road accident
23-sept-19	08:25			
24-sept-19		19:05	34.7	Hydro maintenance work
26-sept-19	21:30			
27-sept-19		07:20	9.8	Outage - electrical storm
01-nov-19	02:55			
02-nov-19		14:45	35.8	Outage - high winds
		Total:	100.8	

2020 Hydro Cuts:

12-janv-20	05:04			
13-janv-20		09:50	28.8	Outage - ice storm (+ 5 hrs to reheat engines to start)
22-janv-20	12:25		0.5	Glitch causes blower VFD's to fault - both engines down 1/2 hour
31-janv-20	13:45		1	Glitch - both engines down 1 hour
	15:22		0.25	Glitch - both engines down 0.25 hour
18-févr-20	15:53		0.3	Glitch - engines down 5 & 33 minutes
	18:15		1.75	Glitch - both engines down 1.75 hours
13-avr-20	22:02			Outage - high winds
14-avr-20		09:43	11.7	
		22:10	12.5	Unable to run over 600 kW due to unbalance (blown fuse on poles)
29-avr-20	09:07		1.3	Glitch - both engines down 1.3 hour
23-mai-20	07:11		1	Glitch stops blower - both engines down 1 hour
24-mai-20	07:16		1	Glitch stops blower - both engines down 1 hour
26-mai-20	07:06		1.25	Glitch stops blower - both engines down 1.25 hour
26-mai-20	15:15		0.25	BOP goes into Lock-Out (all blowers stop)
05-juil-20	02:38		0.75	2 blowers go offline (hydro glitch?)
06-juil-20	22:09		0.75	blowers go offline (hydro glitch?)
25-août-20	13:53	19:30	5.6	Hydro request us to be down 2 hours for repair work on the network
11-sept-20	10:17	11:13	0.9	Power outage - Running only 1 engine without towers
28-oct-20	06:55	07:57	0.5	Gen overload/short circuit opens 1 engine breaker
24-nov-20	11:30		0.5	Glitch stops both engines
28-déc-20	11:19		0.5	Glitch stops both engines
	both engines down for:		**71.1**	hours

2021 Hydro Cuts:

			2 engines	
11-janv-21	08:04		0.5	Glitch stops both engines
26-janv-21	13:54			Hydro request us to be down 24 hours for maintenance work on the network
27-janv-21		17:00	27.1	Glitches after 3pm "good to go" kept us down longer
29-janv-21	05:30			
31-janv-21		23:59	11.75	Glitches and unbalances produce multiple stops until engineer transferred loads to balance lines.
01-févr-21	06:17	08:30	2.22	both on High Voltage (breakers opened)
02-févr-21	15:11	16:30	1.32	both on High Voltage (breakers opened)
06-févr-21	23:22	00:05	0.36	Lena hi volt
	06:38	08:14	0.8	Lena hi volt
	06:46	08:33	0.89	Annie mains failure
	22:36	23:18	0.35	
09-févr-21	01:19	01:23	0.03	
07-avr-21	14:21	16:26	2.083333	Hydro request us to be down 1 hours for maintenance work on the network
16-juil-21	02:26	03:17	0.43	Hydro trip
01-sept-21	19:26	21:13	0.89	Hydro trip Outages service interruption
02-sept-21	06:42	10:10	3.47	Hydro Trip - MDL wasted trip
11-sept-21	01:51	11:19	9.47	Hydro trip
16-nov-21	17:13	18:01	0.80	Hydro trip Annie mains failure (Lena already stop for repair)
17-nov-21	06:42	07:09	0.45	Hydro trip Annie mains failure (Lena already stop for repair)
11-dec-21	20:04	23:59	3.916667	Hydro-Quebec power outages caused by strong winds
12-dec-21	00:00	19:51	19.85	Hydro-Quebec power outages caused by strong winds
		total hours:	86.67	

2022 Hydro Cuts:

28 févier	17h57	20h00	2	Estimation

Changement d'huile

Nom de la machine: J957 (ANNIE)

Date	Heures au compteur	Nombre d'heures depuis le dernier	Nombre de jours
10-Jan-18	45797	1165	54
15-Mar-18	47253	1456	64
5-May-18	48428	1175	51
9-Jul-18	49907	1479	65
11-Sep-18	51319	1412	64
15-Nov-18	52846	1527	65
7-Jan-20	2230	1249	53
21-Feb-20	3251	1021	45
14-Apr-20	4469	1218	53
9-Jun-20	5791	1322	56
27-Jul-20	6918	1127	48
14-Sep-20	8003	1085	49
17-Nov-20	9047	1044	64
6-Jan-21	10219	1172	50
18-Feb-21	11147	928	43
29-Mar-21	12067	920	39
29-Apr-21	12794	727	31
2-Jun-21	13596	802	34
20-Jul-21	14511	915	48
30-Aug-21	15436	925	41
25-Oct-21	16726	1290	56
22-Dec-21	18020	1294	58
17-fev-22	19306		

Nom de la machine: P753 (LENA)

Date	Heures au compteur	Nombre d'heures depuis le dernier	Nombre de jours
19-Mar-18	39161	1545	67
3-May-18	39983	822	45
18-Jul-18	41651	1668	76
11-Oct-18	43575	1924	85
19-Dec-18	45189	1614	69
21-Feb-19	46686	1497	64
11-Feb-20	54657	1260	56
6-Apr-20	55949	1292	55
2-Jun-20	57273	1324	57
4-Aug-20	58761	1488	63
16-Sep-20	60000	1239	43
21-Nov-20	1137	1137	61
7-Jan-21	2255	1118	47
25-Feb-21	3348	1093	49
7-Apr-21	4317	969	41
26-May-21	5479	1162	49
19-Jul-21	6731	1252	54
2-Sep-21	7787	1056	45
29-Oct-21	9075	1288	57
23-Dec-21	10179	1104	55
23-Dec-21	10179	0	0

m3	MWh	MWh/bag	150 ppm output	H2S before	Installed:		N-tower	S-tower	
			51		22-juil-21	100	10 Fe		8'9" from top
			28		19-août-21	79		9 Fe	8'6" from top
			29		17-sept-21	57	12 Fe		60" from top
			55		11-nov-21	196		13 Fe	58"from top
			70		20-janv-22	125			60" from top
					18-août-22				

	Si-Pellets	age(days)
9 Si S-tower	07-nov-12	
1 Si N-tower	13-mars-13	
4 Si N-tower	17-sept-13	314
3 Si S-tower	07-mars-14	171
	Si-tower	
installed(3Si):	27-juin-14	
tied in:	09-juil-14	124
1st change	22-juin-17	1079
2nd change	30-avr-19	677
1st screening		
2nd screening	20-mai-20	
3rd change	21-déc-20	601
today:	18-août-22	605

since 12" line installed:	
days	bags
2876	656

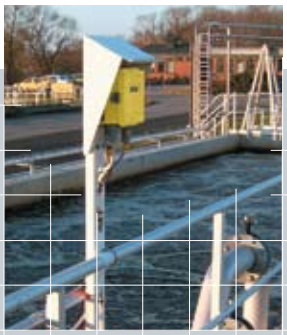
1.75	days per bag before 12" line	
4.38	days per bag since 12" line	
227.98	days lasting on existing stock	
02-mai-22	next shipment needed	
45	days to get shipment	3 weeks to deliver -> 5 weeks (apr 1'20)
18-mars-22	place next order	
96.45	days on one shipment	
20-juil-22	following shipment needed	

	year	bags Fe	bags Su	bags Si	containers
	2012	22		9	1.0
	2013	183	14	5	8.3
	2014	196	5	6	8.9
budget = 65	2015	83	1		3.8
	2016	48			2.2
	2017	113		3	5.1
	2018	122			5.5
	2019	95		3	4.3
	2020	66		3	3.0
	2021	101			4.6
	2022	11			0.5
	used	1040	20	29	
	bought	1092	20	29	
	stock	52	0	0	

Annexe 9 – Instrument de mesure et dispositif

FCI ST98 Series Thermal Mass Flow Meters

Gas Flow Measurement Solutions for Process and Plant Applications



FCI ST98 SERIES

- Chemical
- Wastewater Treatment, Landfills
- Refineries
- Oil & Gas
- Mining
- Metals
- Manufacturing
- Cement, Stone, Brick, Glass
- Power Utilities
- Pulp & Paper
- Food & Beverage
- And more...

FCI® FLUID COMPONENTS INTERNATIONAL LLC

ST98 Series Features

- **Air and Gas Direct Mass Flow Measuring**
- **Flow Rate, Total Flow, and Temperature Display**
- **No Moving Parts, Lowest Maintenance**
- **Line Sizes 1″ to 42″ [25 to 1066 mm]**
- **Precision Calibrated**
- **Fluid Temperatures to 850 °F [454 °C]**
- **Rugged, All-Metal Agency-Certified Enclosures**
- **Integral and Remote Electronics Versions**
- **Comprehensive Approvals for Hazardous Locations**
- **RS232C, HART® and PROFIBUS® Communications**
- **110 Year MTBF**

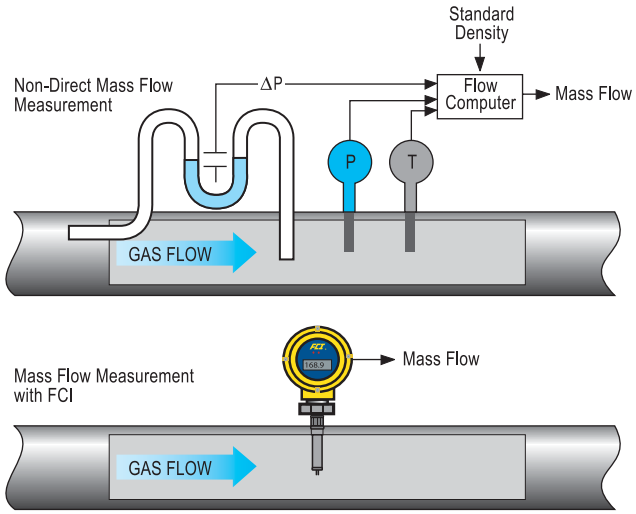
Model ST98 is an insertion flow meter for pipe sizes from 2 1/2″ to 42″ [64 to 1066 mm]. Typical calibration range is from 0.75 to 600 SFPS [0.21 to 172 NMPS].[1]

Model ST98L is an in-line flow meter for use in line sizes 1″, 1 1/2″ and 2″ [DN25, DN40, and DN50]. Typical calibration range is from 0.006 SCFM to 1850 SCFM [0.01 NCMH to 3140 NCMH].[1]

The ST98 Air / Gas Mass Flow Meter Solution

ST98 flow meters combine proprietary equal mass thermal dispersion flow sensing elements, precision electronics, and exacting fluid calibrations, all packaged within rugged, industrial enclosures. The ST98 Series delivers a superior air/gas flow measurement solution that continuously meets performance specifications in the most demanding process and plant applications with virtually no scheduled maintenance.

ST98 flow meters feature FCI's patented no-moving parts flow element design that provides direct mass flow measurement with just a single process penetration. This saves you space and eliminates unnecessary installation, expense, and performance degradation associated with separate temperature and pressure sensors, and density calculation devices needed with inferred mass flow techniques. With no moving parts to plug or foul, ST98's deliver extensive cost savings over alternative high maintenance technologies. The result is an accurate and highly repeatable mass flow measurement at the lowest total installed cost. In today's complex process control schemes, the ST98 Series provides accurate gas flow measurements essential for process consistency, quality and safe plant operation.



FCI's ST98 Series features an accuracy of ±1% of reading, 0.5% of full scale and repeatability of ±0.5% of reading. The turndown ratio is factory preset to your application from a minimum of 10:1 to a maximum of 100:1 and is field adjustable within the calibrated range. ST98 flow meters are offered in a wide range of packaging options, mounting and installation options that ensure configuration matched to your exact application conditions. From compressed air to hydrocarbon gases, single gases to bio-gas mixtures, ST98 flow meters are at work improving processes throughout the world.

[1] *At standard conditions of 70 °F and 14.7 psia [0 °C and 1.013,25 mBara for metric normal conditions]. Actual calibration range depends on actual fluid and conditions.*

Sensors Optimized to Meet the Application

To match your flow application conditions, the ST98 and ST98L are both offered in a choice of two element designs. ST98 choices are –FP and –S. ST98L choices are –F and –S.

Select the –FP and –F style element for applications in dry, clean air/gases with fluid temperatures up to 850 °F [454 °C]. The –FP and –F designs incorporate FCI's exclusive equal mass sensor in smaller diameter thermo-wells for faster response time and improved repeatability in processes with dynamic temperature swings. The –FP also features a protective shroud.

Select the –S style element when your application involves dirty or erosive fluids, high moisture content gas or a pulsating flow. The –S element features more robust, thicker wall thermo-wells and an un-shrouded equal mass sensor element that provides a noise-filtered response, extended erosion resistance, and easier cleaning. In wet/dirty gas applications such as digester, landfill, bio-gases, wet compressed air, or with erosive particulates in the gas, the –S sensor element is often the optimal choice.

ST98 and ST98L models feature an all-welded element to ensure maximum strength, durability and leak proofing. Elements are available in 316L stainless steel or, for applications in highly corrosive fluids, Hastelloy-C materials of construction.

	Sensor Type	Material of Construction	All Welded	Standard Temperature Range to 350 °F [177 °C]	High Temperature Range to 500 °F [260 °C]	Ultra-High Temperature Range to 850 °F [454 °C]
ST98 Insertion	–FP	316L Stainless Steel	Yes	✔		ST98 HT *(new)* ✔
	–FP	Hastelloy-C	Yes	✔		ST98 HT *(new)* ✔
	–S	316L Stainless Steel	Yes	✔	✔	ST98 HT ✔
	–S	Hastelloy-C	Yes	✔	✔	ST98 HT ✔
ST98L In-Line	–F	316L Stainless Steel	Yes	✔		
	–F	Hastelloy-C	Yes	✔		
	–S	316L Stainless Steel	Yes	✔		
	–S	Hastelloy-C	Yes	✔		

Find your gas here?

FCI has provided thermal mass flow meter solutions for all of these and more…

Acetaldehyde
Acetic Acid
Acetone
Acetonitrile
Acetyl Chloride
Acetylene
Air
Allyl Chloride
Ammonia
Aniline
Argon
Benzene
Bio-Gas ($CH_4 + CO_2$)
Boron Trifluoride
Bromine
Bromobenzene
Butadiene
Butene
Butylene Oxide
Butyne
Carbon Dioxide
Carbon Disulfide
Carbon Monoxide
Carbon Tetrachloride
Carbonyl Sulfide
Chlorine
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chloroprene
Cis-2-Butene
Cis-2-Hexene
Cumene
Cyanogen
Cyclobutane
Cyclohexane
Cyclooctane
Cyclopentane
Cyclopropane
Decene
Deuterium
Deuterium Oxide
Diethyl Amine
Diethyl Ether
Diethyl Ketone
Digester Gas (CH_4+CO_2)
Dimethyl Ether
Dimethyl Propane
Dimethyl Sulfide
Ethane
Ethanol
Ethyl Acetate
Ethyl Acrylate
Ethyl Alcohol
Ethyl Amine
Ethyl Benzene
Ethyl Bromide
Ethyl Chloride
Ethyl Fluoride
Ethyl Mercaptan
Ethylene
Ethylene Dichloride
Ethylene Oxide
Flare Gas
Fluorine
Fluorobenzene
Fluoroform
Freon-11
Freon-12
Freon-13
Freon-14
Freon-21
Freon-22
Freon-23
Furan
Halon
Helium
Heptene
Hexanol
Hexene
Hydrazine
Hydrogen
Hydrogen Bromide
Hydrogen Chloride
Hydrogen Cyanide
Hydrogen Deuteride
Hydrogen Fluoride
Hydrogen Iodide
Hydrogen Peroxide
Hydrogen Sulfide
Iodine
Isobutane
Isobutene
Isobutyl Alcohol
Isoheptane
Isohexane
Isooctane
Isopentane
Isoprene
Isopropyl Alcohol
Isopropyl Amine
Ketene
Krypton
Landfill Gas ($CH_4 + CO_2$)
M-Cresol
Mercury
Methane
Methanol
Methyl Acetate
Methyl Alcohol
Methyl Amine
Methyl Butane
Methyl Fluoride
Methyl Formate
Methyl Hexane
Methyl Hydrazine
Methyl Mercaptan
Methyl Octane
Methyl Pentane
Methylal
Methylene Chloride
Morpholine
M-Xylene
Naphthalene
Natural Gas
N-Butane
N-Butane
N-Butanol
N-Butyl Alcohol
N-Decane
N-Dodecane
Neon
Neopentane
N-Heptane
N-Hexane
Nitric Oxide
Nitrogen
Nitrogen Dioxide
Nitromethane
Nitrous Oxide
N-Nonane
N-Octane
Nonene
N-Pentane
N-Propanol
N-Propyl Alcohol
N-Propyl Amine
N-Undecane
Octene
Oxygen
O-Xylene
Ozone
Pentanol
Pentene
Phenol
Phosgene
Propadiene
Propane
Propanol
Propyl Chloride
Propylene
Propylene Oxide
Propyne
P-Xylene
R-11
R-112
R-113
R-114
R-114B2
R-115
R-116
R-12
R-13
R-13B1
R-14
R-142B
R-152A
R-21
R-216
R-22
R-23
R-500
R-502
R-503
R-504
Radon
R-C318
Saturated Steam
Silane
Silicon Tetrachloride
Styrene
Sulfur Dioxide
Sulfur Hexafluoride
Sulfur Trioxide
Superheated
Thiophene
Titanium Tetrachloride
Toluene
Trans-2-Butene
Trimethyl Amine
Triptane
Uranium Hexafluoride
Vinyl Acetate
Vinyl Chloride
Vinyl Fluoride
Vinyl Formate
Water Vapor

Robust, Rugged Electronics and Transmitter

ST98 Series transmitters feature robust, microprocessor-based electronics that undergo rigorous testing and quality assurance checks to ensure continuous, reliable long-term operation in the most demanding installations. The electronics feature FCI's exclusive, multi-poly curve fit linearization technique to achieve maximum flow measurement accuracy and repeatability. All gas calibration data specifics for your meter and your application are stored in non-volatile memory and always retained in the event of a power loss.

All wiring terminal blocks are easily and safely accessed through the ST98 enclosure's front door or via the removable dual-covers of the explosion-proof transmitter. The instrument's universal power supply accepts AC (85 to 260 volts) or 24 Vdc. The transmitter's analog output is field selectable as 4-20 mA, 0-5 Vdc, or 0-10 Vdc. An optional digital, 2 line-by-16 character LCD is available to display flow, temperature and total flow.

Digital Communications

ST98 Series models include a serial RS232C I/O port. Instrument configuration and comprehensive diagnostics are performed via simple connection to a portable PC via hyperterminal mode, or via a FCI Model FC88 portable programmer. Actual measurements, including flow rate, total flow, temperature values, and diagnostics are continuously accessible from the serial output. The industry standard HART and PROFIBUS digital communications protocols are also an available option.

FC88

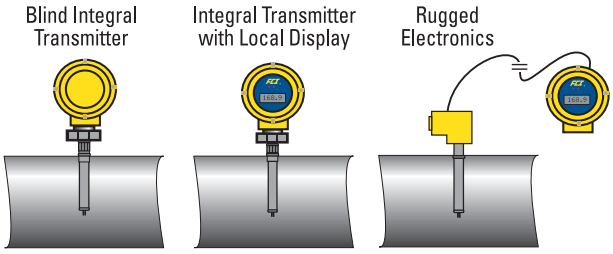
HART® FIELD COMMUNICATIONS PROTOCOL

PROFI® PROCESS FIELD BUS

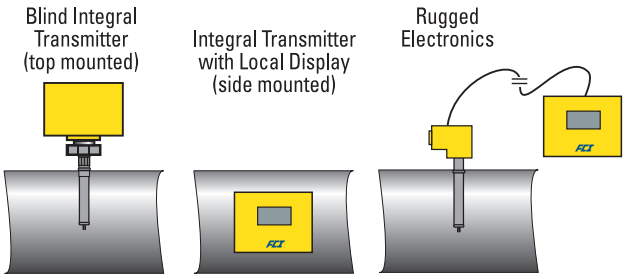
- **HART Field Communications Protocol** For connection in HART networks, the ST98 flow transmitter supports two-way communications for easy access to measured process data, diagnostics, calibration and configuration information. Both flow and temperature data are available as PV1 and PV2 within the HART Protocol. FCI's HART manufacturer ID is 0000A6 and the ST98 device type is 0078. Device description (DD) files are installed and downloadable from the HART web site.
- **PROFIBUS Process Field Bus** ST98's PROFIBUS interface supports connection in a PROFIBUS network as a –DP device. The communications protocol is fully Profile 3 compatible. In addition, FCI optionally offers single instrument and enterprise level DTM software packages to facilitate and reduce the costs of integrating ST98 into the PROFIBUS network. ST98's PROFIBUS has been certified by the PROFIBUS organization, certification number Z01212.

ST98 Insertion

Hazardous Locations

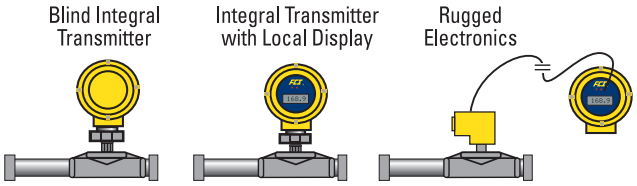


Non-hazardous Locations

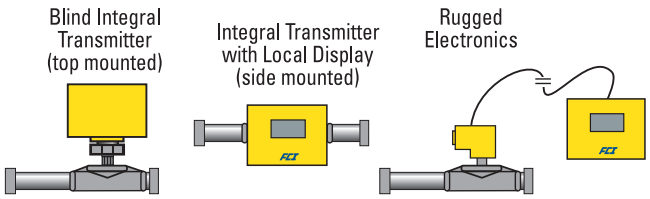


ST98L In-Line

Hazardous Locations



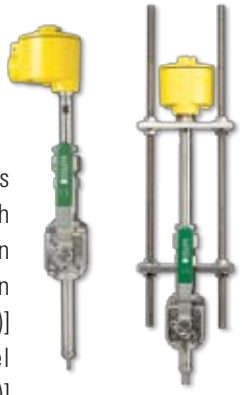
Non-hazardous Locations



Rugged Packaging for Long Service Life and Installation Choices to Match Your Application

ST98 flow meters are offered in several enclosure configurations to ensure application reliability, readability of the digital display, ease of installation and accessibility. These include a weatherproof, carbon steel NEMA/CSA Type 4 [IP66] rated enclosure, an aluminum NEMA/CSA Type 4X [IP66] rated enclosure, or an aluminum explosion-proof enclosure for hazardous locations. Agency approvals include FM, CSA, ATEX, GOST/RTN, IEC, CPA, and NEPSI. Any of the transmitter enclosure choices can be ordered integrally mounted with the sensor probe or for remote mounting up to 1000 feet (350m) away. Hazardous location approvals meet Class I & II, Div.1 & 2, Groups B, C, D, E, F & G; and per ATEX/IECEx II2 GD Exd IIC T4.

Process Connection Choices for Installation Ease



Packing Gland / Ball Valves

Standard process connections for the ST98's insertion flow element are a 3/4 or 1 inch male NPT stain-less steel compression fitting with either an adjustable teflon ferrule, rated to 150 psig [10 bar(g)] and 200 °F [93 °C], or a stainless steel ferrule, rated to 250 psig [17 bar(g)] and 500 °F [260 °C]. Optionally available are ANSI or DIN flanges, and retractable packing glands with 1 1/4 inch NPT or flanged connections. The ST98 insertion flow meter is offered in three standard element lengths of 6, 12, or 21 inches [152, 305 or 533 mm], which are field adjustable for final insertion depth to match your application. Longer and fixed insertion lengths, and all-welded process connections are also available upon request. High temperature service model ST98HT is available as a 1 inch male NPT or flanged in fixed insertion lengths up to 60 inches [1524 mm]. Adjustable insertion length requires retractable packing gland configuration.

For the ST98L in-line model, the standard process connections are male or female NPT and ANSI or DIN flanges. The flow tube or pipe length is 9-times its nominal diameter (e.g. a 1 inch pipe model will have a 9 inch long flow tube). Additionally, ST98L may be supplied with built-in Vortab® flow conditioners to reduce straight-run requirements and eliminate swirl and distorted flow profiles.

FCI Calibration Ensures Installed Accuracy

The ST98 Series is tested and calibrated to rigorous standards to ensure you get the instrument that does the job you specified. To design and produce the highest quality flow instrumentation, FCI operates a world-class NIST traceable flow calibration laboratory certified to meet such stringent standards as MIL-STD 45662A and ANSI/NCSL Z-540.

For most gases, FCI ST98 thermal dispersion flow meters are calibrated using the actual gas as well as the actual temperature and process conditions matching your application. Other suppliers are limited to air calibration with un-validated theoretical equivalencies for gases. FCI has demonstrated this procedure to be inferior and subject to installed errors well outside published specifications. For most other suppliers to perform actual gas calibrations equal to FCI, their flow meter must be sent to an outside laboratory resulting in extra costs and shipping delays to you.

FCI's calibration results in a flow meter you can install with total confidence and assurance that it meets your application needs.

More than 16 precision flow stands to match fluids, process conditions, flow rates and line sizes specified in your application.

ST98 Special Configurations

ST98HP – High and Ultra High Purity Applications

For gas applications in pharmaceutical, biotech, food, beverage, semiconductor, or other industries where high purity finishes are required, the model ST98HP is the solution. The ST98HP provides all of the standard features and options of the ST98, combined with electropolish finishes and sanitary process connections. ST98HP is available for line sizes 3/4 inch through 4 inches. The ST98HP is offered in two versions:

- **High Purity** 15Ra finish with a sanitary flange mated to a 316L in-line flow tube. The flow tube can be specified for either butt weld or sanitary flanged process connections.
- **Ultra High Purity** 10Ra finish with a VCR connector mated to a 316L in-line flow tube. The flow tube can be specified for either butt weld or sanitary flanged process connections.

ST98HP is engineered for High Purity applications.

The ST98HP for Ultra High Purity applications has a 10Ra finish.

ST98B – Compressed Air / Air / Nitrogen

Specifically for applications in compressed air, air, or nitrogen, FCI manufactures the ST98B models as standardized configurations of the ST98. The pre-configured and calibrated ST98B is easy to order and stocked for quick delivery.

Model ST98B-CA, for compressed air, is calibrated for a range of 6 to 600 SFPS [1.8 to 183 NMPS]. Model ST98B-AN, for air or nitrogen, is calibrated for 1.25 to 125 SFPS [0.4 to 38 NMPS]. The insertion element has a 3/4 inch diameter (with -FP element) and is offered in two U-lengths; 6 inch [152 mm] and 12 inch [395mm] with male NPT compression fitting and Teflon ferrule for field adjustment to the final insertion depth. The flow meter's transmitter housing is the NEMA 4 [IP66] carbon steel box, and can be ordered as a blind unit or with LCD digital display, in an integral or remote configuration. All other specifications of the ST98 insertion are standard.

Standardized ST98B models are pre-configured and calibrated for compressed air / air or nitrogen.

ST98 Special Treatments, Options and Accessories

Fluid Components International is committed to providing solutions for even the toughest application challenges. FCI has engineered a variety of options and accessories for ST98 models to perform in extraordinary conditions – just a few examples are shown here. Contact FCI with any special needs or for engineered solutions to your specific application.

- **Vortab Flow Conditioners** For plant conditions with limited piping straight-run or significant flow disturbances, FCI ensures accurate and repeatable measurements using Vortab flow conditioners. The patented, proven Vortab technology is widely recommended by industry experts to be the single most effective solution for flow conditioning and flow straightening. FCI is the only thermal dispersion flow technology provider authorized to provide Vortab flow conditioners with its products.

Vortab® Flow Conditioners ensure accurate and repeatable flow performance.

- **Sun and Wind Enclosure Shades** In outdoor installations with constant heat, glaring sun or blowing sand, special sun shades provide additional protection to ensure reliability and operations of the transmitter electronics and the LCD digital display when used with remote enclosures.

A sun and wind shade will help protect the remote transmitter.

- **Element Coatings and Materials** For service in highly corrosive gases or with erosive particulates, FCI can provide special coatings and wetted materials to protect the element and provide longer service life. Examples include Kynar, Tantalum, and Chromium Carbide.

Protective coatings are available for highly corrosive and erosive enviroments.

ST98 Series Features

Remote up to 1000' [350m]

Dual conduit ports for separate power input and signal output lines

Universal AC and DC power supply

Weather-proof, ruggedized, enclosures
- Choices for local or remote mounting
- Choices of NEMA/IP rated box or hazardous location installation

Easy-to-read, 2-line LCD display
- Display flow, temperature, and/or total flow with engineering units
- Display service codes

Global Agency Approvals of entire instrument for hazardous location installations:

FM, ATEX, CSA, IEC, GOST/RTN, CPA, NEPSI

Analog and digital communications outputs
- 4-20 mA or 0-10 Vdc
- RS232C, HART, or PROFIBUS DP

Multi-function: measures mass flow rate and temperature

Simple, adjustable installation with threaded NPT connector; Teflon or metal ferrule seals

Insertion and In-Line styles to match pipe size application

Stainless steel or Hastelloy-C wetted parts

All welded sensor elements for maximum service life and leak-proofing

Precision, wide-ranging Platinum RTD sensors

Exclusive equal mass elements provide optimum performance in processes with wide temperature swings

ST98 Series Mass Flow Meter General Specifications

Instrument

- **Flow Range**
  ST98 Insertion Flow Element: 0.75 SFPS to 600 SFPS [0.21 NMPS to 172 NMPS]
  ST98L In-Line Flow Accessory: 0.0062 SCFM to 1850 SCFM [0.01 Nm3/h to 3,140 Nm3/h]
  – Air at standard conditions; 70 °F and 14.7 psia [0 °C and 1013,25 bar (a)]
- **Media:** All gases that are compatible with the flow element material
- **Accuracy**
  Flow: ±1% reading, 0.5% full scale standard accuracy
  Temperature: ±2 °F [±2 °C] (display only, flow rate must be greater than 5 AFPS [1,5 m/sec])
  Special higher accuracy calibration options available; contact FCI
- **Repeatability**
  Flow: ±0.5% reading
  Temperature: ±1 °F [±1 °C] (flow rate must be greater than 5 AFPS)
- **Temperature Coefficient**
  With optional temperature compensation. Valid from 10% to 100% of full scale calibration.
  Flow: Maximum ±0.015% of reading / °F up to 850 °F [±0.03% of reading / °C up to 454 °C]
- **Turndown Ratio**
  Standard: Factory set and field adjustable from 10:1 to 100:1 within calibrated flow range
- **Temperature Compensation**
  Standard: ±30 °F [±16 °C]
  Optional: ±100 °F [±55 °C]
- **Agency Approvals**
  FM, ATEX, CSA, CRN, IEC, CPA, NEPSI, GOST/RTN, CE, PED (system approvals) **†**
- **Calibration:** Performed on NIST traceable equipment
- **MTBF (calculated):** 110 years

Flow Element

- **Material of Construction**
  All-welded 316L stainless steel; Hastelloy-C optional
- **Operating Pressure**
  Metal ferrule: 250 psig [17 bar (g)]
  Teflon ferrule: 150 psig [10 bar (g)]
- **Operating Temperature (Process)**
  ST98 Insertion Style:
  – FP type element: -40 °F to 350 °F [-40 °C to 177 °C]
  – S type element: -40 °F to 350 °F [-40 °C to 177 °C]
  – S type (optional) element: -40 °F to 500 °F [-40 °C to 260 °C]
  ST98 HT Insertion Style (High Temperature Service)**: *†**
  – FP type element: -40 °F to 850 °F [-40 °C to 454 °C]
  – S type element: -40 °F to 850 °F [-40 °C to 454 °C]
  ST98L In-Line Style:
  – F & – S type elements: -40 °F to 350 °F [-40 °C to 177 °C]
- **ST98 Insertion Flow Element**
  Process Connection:
  3/4″ or 1″ male NPT stainless steel compression fitting: adjustable Teflon ferrule; 150 psig [10 bar (g)] and 200 °F [93 °C] max., or metal ferrule; 250 psig [17 bar (g)] and 350 °F [177 °C] max.;
  thread-on flange optional; 1 1/4″ male NPT or flanged retractable packing gland optional*****

  Insertion Length: Field adjustable lengths –
  1″ to 6″ [25 to 152 mm]
  1″ to 12″ [25 to 305 mm]
  1″ to 21″ [25 to 533 mm]
  Custom lengths optional*****
- **ST98L In-Line Flow Tube**
  Insertion flow element is threaded and keyed in an in-line flow tube, calibrated and supplied as a spool-piece; accessories include low flow injection tubes and built-in Vortab flow conditioners for optimum low flow rangeability and performance

  Size: 1″ diameter tubing; 1″, 1 1/2″ or 2″ schedule 40 pipe
  Length: 9 nominal diameters
  Process Connection: Female NPT, male NPT, ANSI or DIN Flanges
  Option: Flanges sized for flow tube
- **Remote Transmitter Configuration:** Transmitter may be mounted remotely from flow element using interconnecting cable (up to 1000 feet [350m])*****

Flow Transmitter

- **Operating Temperature:** 0 °F to 140 °F [-18 ° to 60 °C]
- **Input Power:** 85 Vac to 265 Vac or 22 Vdc to 30 Vdc, 7 Watts maximum, 230 mA maximum
- **Outputs**
  Analog: Single output selectable as 4-20 mA****** (700 Ω max. load), 1-5 Vdc, 0-10 Vdc or 0-5 Vdc. (Vdc: 100K Ω min. load)

** *With fault indication per NAMUR, NE43 guideline: field selectable for high (≥21.6 mA) or low (≥3.75 mA) output signal is isolated from input power on AC Powered mode only)*

Digital: Standard: RS232C Serial I/O

Optional: HART, full two-way communications*****; PROFIBUS, DP Profile 3 (Certification #Z01212)

Digital Display (optional): LCD, 2 line/16 character per line, indicating flow rate and process temperature and/or totalized flow

Other Options

- **Vortab Flow Conditioners:**
  Model ST98L (in-line) can be provided and system calibrated with Vortab flow conditioners; refer to FCI + Vortab literature and contact FCI
- **Model FC88:** Hand-held, portable FCI flow meter field programmer; attach to ST98 I/O port for instrument set-up and trouble shooting

* *Some configuration restrictions apply to ST98 HT configured for 850 °F [454 °C] service. These include, but may not be limited to the following: Must select remote transmitter configuration. HART output is standard. Insertion element is fixed length with 1″ male NPT or adjustable with selection of packing gland. Contact FCI for more information.*

† *Agency approvals for 850 °F [454 °C] version pending. Contact FCI for current availability.*

Enclosures

	For Integral Configurations (Flow Meter/Transmitter Together)		
Ordering Code Number	A	1	B
Type	Carbon Steel Box	Aluminum Box	Aluminum Round
Temperature	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]
Environmental Rating	NEMA 4, IP66	NEMA 4X, IP66	NEMA 4X, IP66
Installation Area Rating (System Approvals)	Nonincendive for Class I, Division 2, Groups A,B,C,D; Suitable for Class II, Division 2 Groups F, G; Class III, Division 2	Nonincendive for Class I, Division 2, Groups A,B,C,D; Suitable for Class II, Division 2 Groups F, G; Class III, Division 2	Class I, Division 1 Hazardous Locations: Groups B,C,D, E, F, G; ATEX / IECEx II2 GD Exd IIC T4

	For Remote Configurations * (Flow Meter Element Separated from Transmitter)				
Ordering Code Number	Element	Transmitter	Transmitter	Transmitter	Transmitter
	C, 2, D or E	C	2	D	E
Type	Aluminum	Carbon Steel Box	Aluminum Box	Aluminum Round	Panel Mount
Temperature	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]	0 °F to 140 °F [-18 °C to 60 °C]
Environmental Rating	NEMA 4, IP67	NEMA 4, IP66	NEMA 4X, IP66	NEMA 4X, IP66	None
Installation Area Rating (System Approvals)	Class I, Division 1 Hazardous Locations: Groups B,C, D, E, F, G; ATEX / IECEx II2 GD Exd IIC T4	Nonincendive for Class I, Division 2, Groups A,B,C,D; Suitable for Class II, Division 2 Groups F, G; Class III, Division 2	Nonincendive for Class I, Division 2, Groups A,B,C,D; Suitable for Class II, Division 2 Groups F, G; Class III, Division 2	Class I, Division 1 Hazardous Locations: Groups B,C,D, E, F, G; ATEX / IECEx II2 GD Exd IIC T4	None

More Air / Gas Mass Flow Meter Solutions

In addition to the ST98 Series, FCI manufactures a broad line of thermal dispersion flow meter products for industrial and plant applications. From general-purpose air flow measurement to special-function, mixed gas flare flows; from small line sizes to the largest stacks and ducts, FCI has the selection to best solve your applications and ensure optimum solutions. Contact your local FCI representative or visit **www.fluidcomponents.com** for detailed product information and specifications on these products.


ST50

- **ST50** is a compact and economical, yet full featured meter designed for air, compressed air and nitrogen applications.


ST75

- **ST75** is a compact, in-line meter with extensive standard features that is the economical, easy-to specify alternative to other maintenance intensive flow technologies.


GF90 Series

- **GF90** and **GF92** offer an extensive feature suite and unique 3-gas calibration option that solves the toughest industry application requirements.


GF03

- **GF03** is specifically designed for flare flow metering and to meet the stringent environmental regulations that apply to this application.

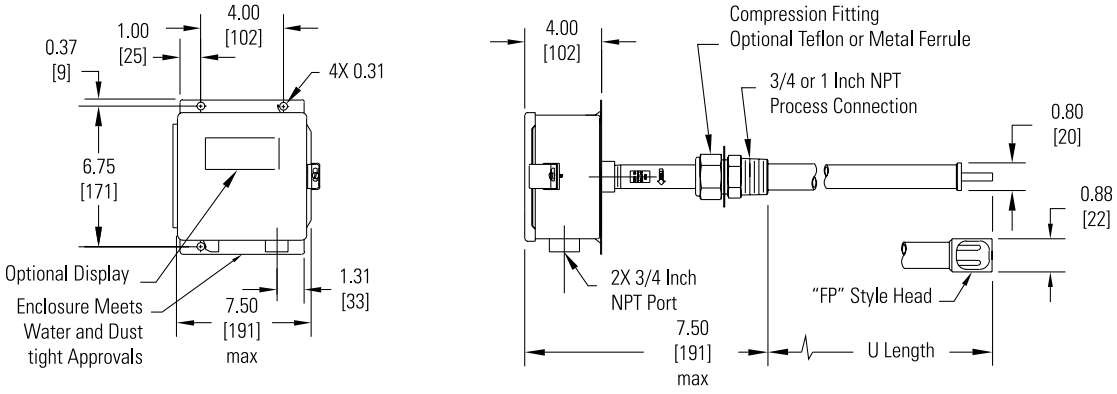

MT86 / MT91 Series

- **MT86** and **MT91** "multi-point" flow measuring systems can be configured with two (2) to sixteen (16) flow sensing elements to optimize measurements within the largest of pipe and duct sizes.

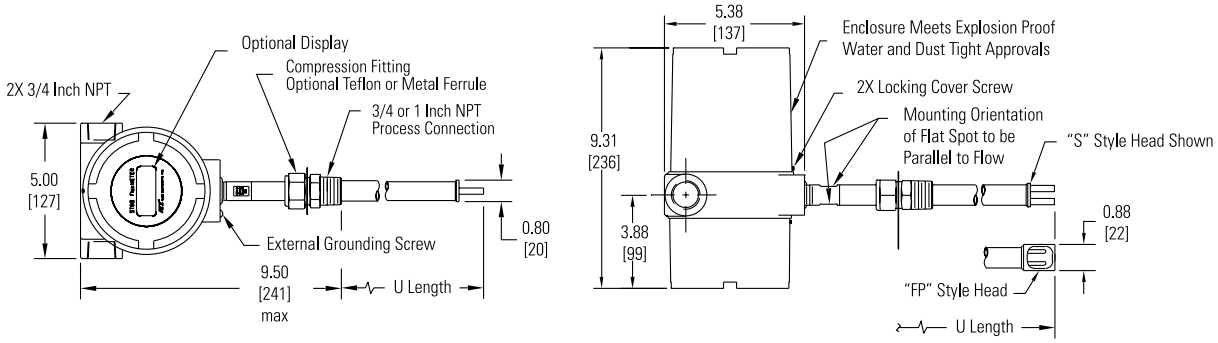
Model ST98 Insertion Flow Meter

Integral Transmitter

NEMA 4 Carbon Steel (Standard) or NEMA 4X, Aluminum

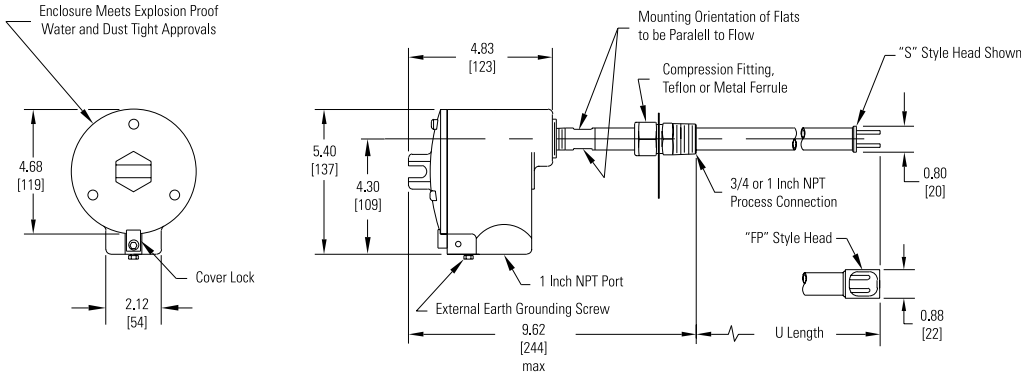


Hazardous Locations, Aluminum

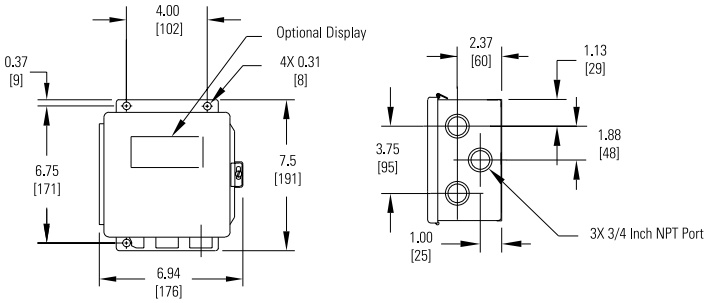


Remote Configuration

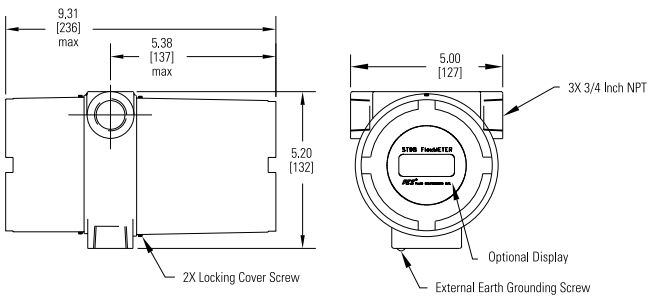
Flow Element: Hazardous Locations, Aluminum



Enclosure: NEMA 4 Carbon Steel or NEMA 4X Aluminum



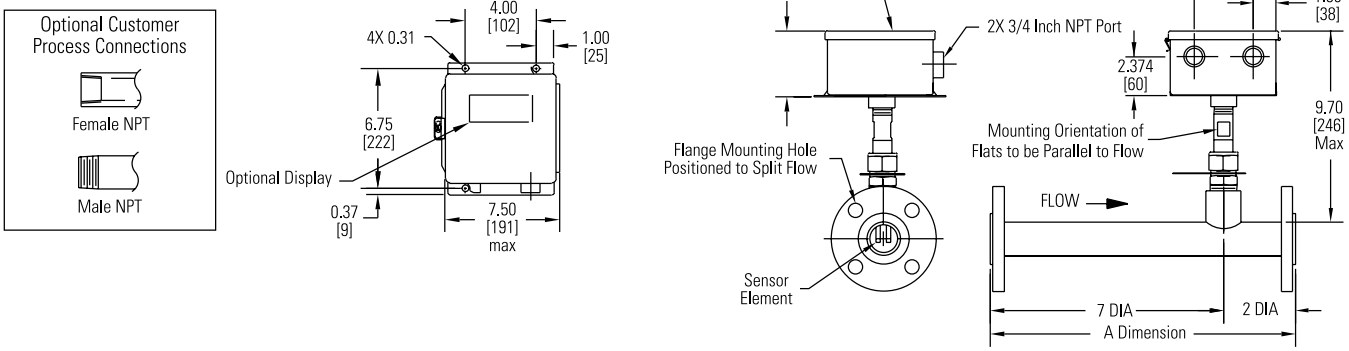
Enclosure: Hazardous Locations



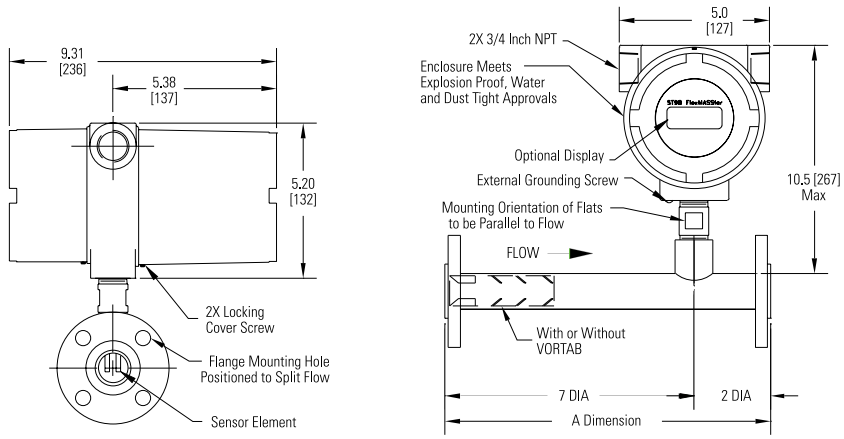
Model ST98L In-Line Flow Meter

Integral Transmitter

NEMA 4 Carbon Steel (Standard) or NEMA 4X, Aluminum



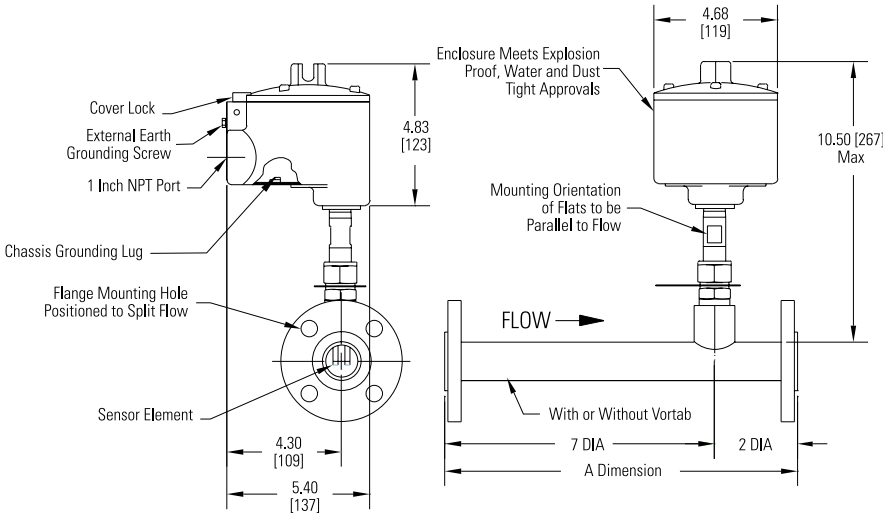
Hazardous Locations, Aluminum



Note: Optional flange connections are shown for reference only.
Standard process connection is male NPT.

Remote Configuration

Flow Element: Hazardous Locations, Aluminum
Transmitter: See Remote Configurations for ST98 Insertion Flowmeter



FCI® FLUID COMPONENTS INTERNATIONAL LLC

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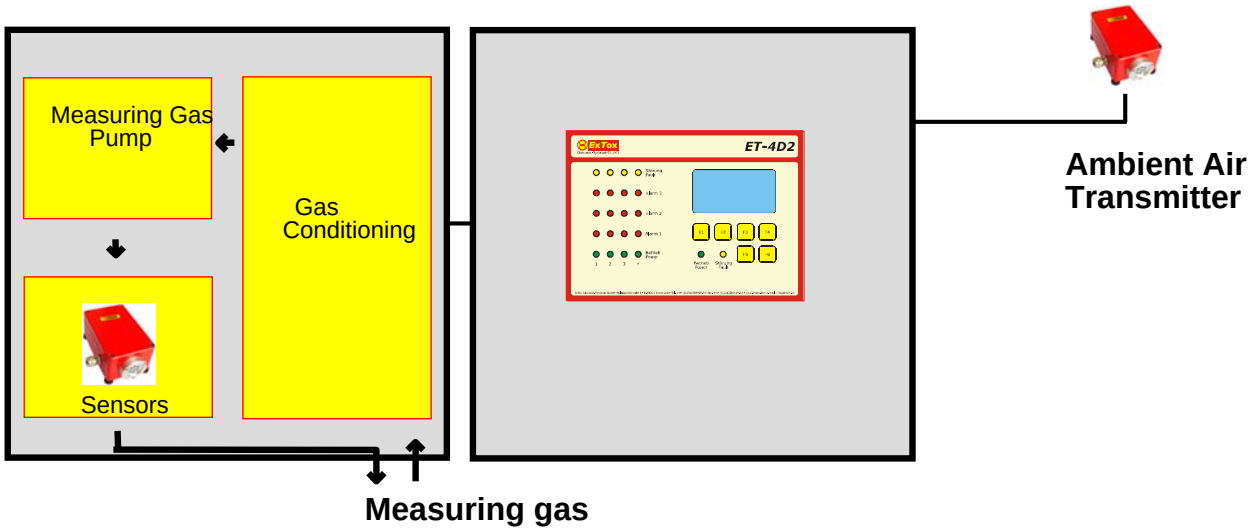
Phone: 31-13-5159989 Fax: 31-13-5799036

FCI is ISO 9001:2000 and AS9100 Certified

0509-0K **Doc. No. 02MK011469H**

Integral Measuring Concept IMC-4D(A)2
Article-No.: 420108 (420109)



Description	Integral Measuring Concept: ▪ Sampling and conditioning of measured gas, transmitter and evaluation combined in one compact wall mounted housing. ▪ At the same time possibility of continuous monitoring of ambient air. ▪ Four 4-20 mA-outputs (only 420109: IMC-4DA2)
Features	
Transmitter	▪ Number: 1 to 4 ▪ Allocation of transmitter inputs to analysis including sampling and conditioning of measured gas as well as monitoring of ambient air freely selectable ▪ Selection out of ExTox-Series Sens(-I) and ExSens(-I)
Signal Processing	▪ Control Unit ET-4D2 or ET-4DA2 for 4 transmitter inputs, incl. 8 freely configurable relay outputs and serial interface; additionally control of sampling and conditioning of measured gas as well as evaluation of status messages. ▪ Software Extension IMC ▪ Continuous monitoring of ambient air
Sampling of Measured Gas	▪ Gas suction pump and electronic flow rate monitoring ▪ Maximum length of sample line ≥ 50 m ▪ Manual condensate trap ▪ Magnetic valve to change from measured gas to test gas ▪ Hosing: PE/PP ▪ Dust filter
Connections	At the bottom of the housing for 4/6-Hose (inner / outer Ø: 4/6 mm) ▪ 3 glands for measured gas inlet, test gas and gas outlet ▪ 1 gland for condensate outlet
Operation Temperature	+5 °C to +40 °C
Pressure at sampling point	-100 hPa to +100 hPa (relative to ambient)
Mechanical Features	
Dimensions	Standard version: 600 mm x 600 mm x 350 mm (Height x Width x Depth)
Housing	Wall mounted housing with door, mounting plate, foamed-in door sealing, 2 cam locks
Material	Steel, powder-coated in textured RAL 7035
Climatisation	2 fans, rotary speed monitored (at the same time leakage protection)
Storage Temperature	-25 °C to +60 °C
Electrical Features	
Power Supply	▪ 230 V AC ▪ Power Supply 230 V AC/24 V DC, 120 W integrated
Cable Gland	At the bottom of the housing ▪ 1 x M20 x 1.5 (diameter of cable 7-13 mm) ▪ 10 x M16 x 1.5 (diameter of cable 5-10 mm)
Terminal Assignment	▪ Power supply ▪ Central connection PCB for transmitter and digital inputs and relay outputs

Options

- Monitoring of Ambient Air:

  A continuous monitoring of ambient air can also be realised via external ExTox-Transmitters.

- Flame Arrestor Ⓔx IIG IIB3 (Standard) or Ⓔx IIG IIC:

  When sampling in hazardous areas the gas flow inside the IMC is decoupled of the monitored process as far as the danger of explosion is concerned. The flame arrestor is connected to the measured gas inlet. When returning the measured gas into the process another flame arrestor at the measured gas outlet is necessary.

- Condensate trap incl. Hose pump:

  Removal of condensate is automatically done by hose pump.

- Measured gas cooler including automatic removal of condensate:

  Gas dehumidification by means of a Peltier cooler, temperature of measured gas at outlet: +5 °C
  (Recommended for very high humidity content in measured gas.)

- Hydrophobic dehumidification of measured gas:

  Dehumidification of gas is done via a chemical exchange process.
  (Recommended for very high humidity content in measured gas.)

- Heating for enclosure with thermostat control +5 to +30 °C :

  Necessary for very low temperatures at the place of application. Formation of condensate inside the housing is avoided when installing the IMC outside.

- ProfiBus®-Connection:

  Measured values and messages can be transferred to a ProfiBus® via Interface. (Further connections to superior systems on request).

- Data Logger:

  Measured values and messages are stored on a SD memory card. All data can be read out and processed on every standard PC later on.

- Customer specific modifications – Ask us!

  Different applications also require different monitoring concepts. The modular design of our IMC-Systems allows us to respond to your special wishes and requirements.

This Data Sheet is at the same time a type specific supplement
to the Instruction Manual *ExTox Integral Measuring Concept Series IMC-8 and IMC-4.*

(Subject to technical changes)

Annexe 10 – Vérification et étalonnage des instruments de mesure

TETRA TECH

RAPPORT DE SERVICE

Nom du client :	Terreau Biogaz inc.
Adresse du site:	702, route 139, Sainte-Cécile-de-Milton (Qc) Lieu d'enfouissement sanitaire (LES) fermé
Personne-contact :	Louis-Philippe Robert-Gemme
Date :	24 mars 2022
Responsable de la vérification :	Marc-André Brouillard, ing.

1.0 OBJET DE LA VÉRIFICATION

Tetra Tech QI inc. (Tetra Tech) a été mandaté afin de vérifier l'exactitude du débitmètre de projet de type « thermique massique » qui sert à mesurer le débit de biogaz soutiré de l'ancien lieu d'enfouissement sanitaire (LES) fermé de Sainte-Cécile-de-Milton.

L'adresse du site est le 702, route 137, Sainte-Cécile-de-Monton, Québec, J0E 2C0.

La vérification est effectuée avec un tube de Pitot de type L. Une comparaison est faite entre les valeurs obtenues à l'aide de cet instrument aux valeurs mesurées par le débitmètre du projet.

Les mesures ont été effectuées au site susmentionné le 24 mars 2022.

2.0 CONDITIONS D'OPÉRATION

M. Louis-Philippe Robert-Gemme était présent lors de la vérification, afin de s'assurer du bon fonctionnement du procédé de soutirage de biogaz.

3.0 MÉTHODOLOGIE

3.1 INSTRUMENTS UTILISÉS

Les équipements suivants ont été employés pour effectuer la vérification de l'exactitude du débitmètre du projet :

- Tube de Pitot de type L de marque Dwyer modèle 166-12 I.D. 108022-00
- Manomètre numérique différentiel de marque Kimo modèle MP 210 (nº de série 1D220204311) avec module de pression (nº de série 1D220202182)
- GEM5000 de marque Landtech (nº de série G501761)

Les équipements font l'objet d'un entretien régulier, et d'un étalonnage annuel. Les certificats d'étalonnage des équipements sont présentés à l'**Annexe A** .

La résolution du manomètre numérique Kimo, fonctionnant avec le module de pression, est de +/- 1 Pa.

...2

3.2 PARAMÈTRES

La température, ainsi que la composition du biogaz (teneur en CH_4, CO_2, O_2 et N_2), ont été mesurées à l'aide de l'appareil GEM5000. Le certificat d'étalonnage de ce dernier est rapporté à l'**Annexe A** .

Le débit de biogaz est établi à l'aide de la méthode de référence SPE 1/RM/8 d'Environnement Canada[1], méthode d'essai B « Détermination de la vitesse et du débit-volume des gaz de cheminée ».

La pression différentielle, ainsi que la pression statique, ont été mesurées à l'aide du tube de Pitot raccordé au manomètre numérique.

La pression barométrique au moment de la vérification a été obtenue en consultant les résultats des conditions météorologiques d'Environnement Canada.

4.0 RÉSULTATS

4.1 CONDITIONS DE RÉFÉRENCE

Le débit est calculé aux conditions de référence du débitmètre du projet, soit 101,325 kPa et 0°C.

La fiche technique du débitmètre du projet est rapportée à l'**Annexe B**.

4.2 MESURES

Pour chacun des points de mesure du tableau des mesures, les valeurs indiquées correspondent à la moyenne arithmétique de quatre (4) lectures ponctuelles.

La pression barométrique au moment de la prise des mesures était de 101,3 kPa (source Environnement Canada).

Tableau 1 : Composition du biogaz

	Type de gaz : biogaz d'un lieu d'enfouissement de matières résiduelles	
	Valeur	Unité
Température	9,8	°C
CH_4	52,0	% v/v
CO_2	32,7	% v/v
O_2	2,0	% v/v
N_2	13,3	% v/v

[1] https://www.canada.ca/fr/environnement-changement-climatique/services/registre-environnemental-loi-canadienne-protection/publications/methode-reference-mesure-rejets-particules/methode-b.html

…3

Tableau 2 : Mesures de pressions différentielles

Points de mesure	Conduite : PeHD DR11 DN150 (NPS 6) Diamètre interne mesuré : 130 mm	
	Distance à partir de la paroi interne (mm)	Pression différentielle (mm CE)[1]
1	12,7	0,4
2	19,11	0,5
3	38,35	0,6
4	91,65	0,6
5	110,89	0,5
6	117,3	0,5

1. mm de la colonne d'eau

Pendant les mesures, la pression statique (manométrique) moyenne dans la conduite était de -658,0 mm CE (-64,55 mBar-g).

4.3 RÉSULTATS

La vitesse de l'écoulement de gaz est calculée pour chaque point de mesure. Les résultats sont présentés dans le tableau 3.

Tableau 3 : Résultats – vitesse moyenne de l'écoulement de gaz

Points de mesure	Vitesse calculée (m/s)
1	2,7
2	3,0
3	3,3
4	3,3
5	3,0
6	3,0
Moyenne arithmétique	3,0

Tableau 4 : Résultats – débit de gaz aux conditions de référence

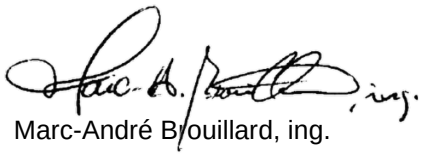
	Valeur	Unité
Débit calculé	131,5	Nm³/h
Lecture du débitmètre du projet (moyenne de 5 lectures ponctuelles)	129,0	Nm³/h

…4

4.4 ANALYSE

Le % d'écart (ou erreur relative (%)) est calculé selon la prescription de l'article 27 du *Règlement relatif aux projets de valorisation et de destruction de méthane provenant d'un lieu d'enfouissement admissibles à la délivrance de crédits compensatoires* (chapitre Q-2, r. 35.5).

Le % d'écart obtenu avec le débitmètre du projet est de -1,9%.



Marc-André Brouillard, ing.
Chef d'équipe

MAB/caq

p. j. Annexe A : Certificats d'étalonnage des instruments
Annexe B : Fiche technique du débitmètre du projet

…5

ANNEXE A : CERTIFICATS D'ÉTALONNAGE DES INSTRUMENTS

La Cie J. CHEVRIER INSTRUMENTS INC

4850, bd Gouin est
Montréal-Nord, QC
Canada H1G 1A2
www.chevrierinstruments.com

1975 - 2020 45 ANS

Tél. 514-328-2550
1 800-522-1226
Fax 514-327-0604
info@chevrierinstruments.com

Instruments de mesure et de régulation pour les procédés industriels et laboratoire d'étalonnage

Certificat d'étalonnage

Date d'émission: 2022-03-08 **Numéro du Certificat: CE140825**

Étalonnage effectué par:

LA CIE J. CHEVRIER INSTRUMENTS INC.
4850 GOUIN EST
MONTREAL, QC, CANADA H1G 1A2

Pour:

28215
TETRA TECH QI, INC
1205, RUE AMPÈRE
BOUCHERVILLE, QC, CANADA, J4B 7M6

Informations sur l'Instrument:

Description:	TUBE DE PITOT EN L 12" X 1/8"		
Manufacturier:	DWYER	Date d'étalonnage:	2022-03-08
Modèle:	166-12	Échéance:	2023-03-08
Numéro de série:			
I.D.:	108022-00	État de l'instrument:	BON
Conditions ambiantes:	19.7°C / 22.1%HR / 1016 mBar	Technicien:	Abdenbi El Faiz

Approuvé par: Catherine Gravel-Chevrier - DIRECTRICE LABO

A.E

En général, le ratio de précision étalon/instrument est d'au moins 4 pour 1.

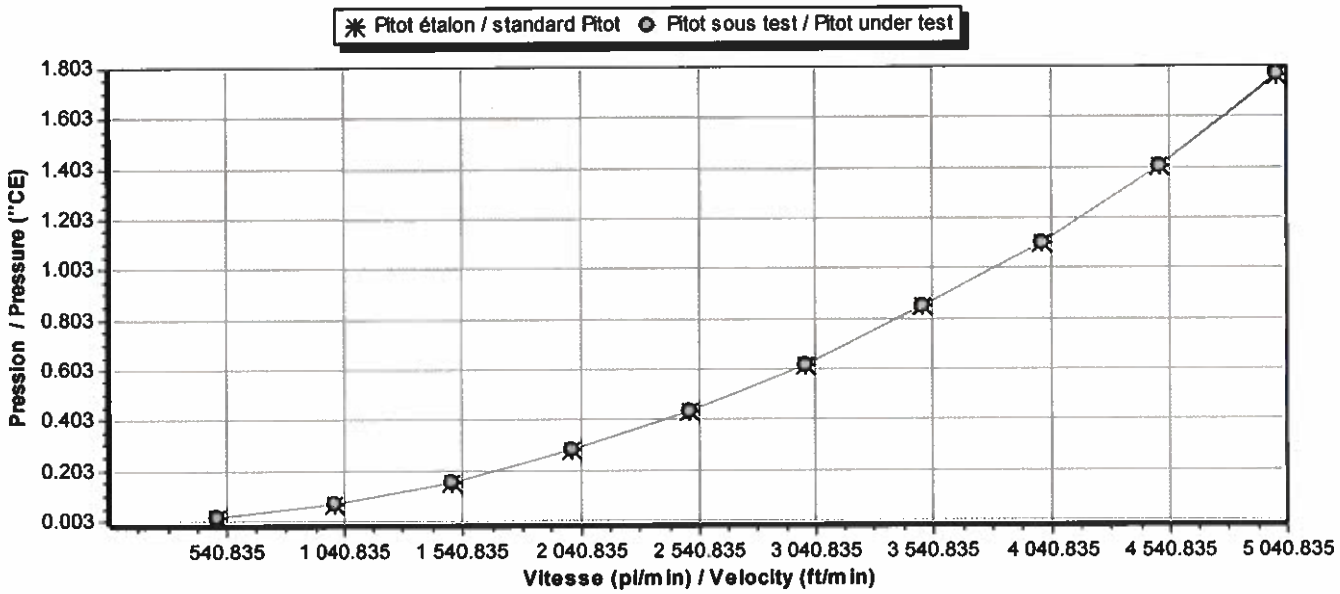
Certificat d'étalonnage

Date d'émission: 2022-03-08 **Numéro du Certificat: CE140825**

POINTS D'ÉTALONNAGE

Vitesse nominale pi/min	Pression Diff. Pitot étalon "H2O	Pression Diff. Pitot sous test "H2O	Vitesse calculée Pitot étalon pi/min	Vitesse calculée Pitot sous test pi/min	Coef. Pitot étalon X (dP étalon / dP Pitot)^0.5
500.0	0.0181	0.0181	537.7	537.7	1.000
1000.0	0.0707	0.0707	1062.7	1062.7	1.000
1500.0	0.1582	0.1581	1589.7	1589.2	1.000
2000.0	0.2808	0.2805	2117.9	2116.8	1.001
2500.0	0.439	0.437	2648.1	2642.1	1.002
3000.0	0.619	0.615	3144.5	3134.3	1.003
3500.0	0.856	0.853	3697.8	3691.3	1.002
4000.0	1.108	1.103	4207.0	4197.5	1.002
4500.0	1.409	1.405	4744.2	4737.4	1.001
5000.0	1.773	1.769	5321.8	5315.8	1.001
				Coefficient moyen:	1.001

Courbe d'étalonnage



En général, le ratio de précision étalon/instrument est d'au moins 4 pour 1.

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1 800-522-1226
Fax 514-327-0604
info@chevrierinstruments.com

Instruments de mesure et de régulation pour les procédés industriels et laboratoire d'étalonnage

Certificat d'étalonnage

Date d'émission: 2022-03-08 **Numéro du Certificat: CE140825**

Étalons utilisés traçable au C.N.R.C / N.I.S.T

I.D.	Certificat No	Description	Étalonné le	Échéance
CHEV031	**CE139424**	TUYÈRE AIRFLOW DEVELOPMENTS	2022-02-07	2023-02-07
CHEV089	**EEV2000001**	TUBE DE PITOT DROIT ELLIPSOÏDAL	2022-01-19	2025-01-19
CHEV290EQ	**QAT1600166**	INDICATEUR MULTIFONCTIONS AMI310		
CHEV296ET	**CE129652**	MODULE DIFFERENTIEL DES PRESSIONS KIMO MPR500	2021-06-01	2022-06-01

Procédures utilisées pour effectuer cet étalonnage

Procédure	Description	Date de révision
3PR77-012CHE	ÉTALONNAGE DE TUBE DE PITOT	2018-06-29

En général, le ratio de précision étalon/instrument est d'au moins 4 pour 1.

CERTIFICAT D'ETALONNAGE
CALIBRATION CERTIFICATE
N°ZSMO2218194V01

Délivré à : **CHEVRIER INSTRUMENTS**
Issued for :

4850, Bld Gouin est

H1G 1A2 Montréal-Nord Qc.

INSTRUMENT ETALONNE
CALIBRATED INSTRUMENT

Désignation : **Thermo-anémo-manomètre MP210**
Designation : **Thermo-anemo-manometer MP210**

Constructeur : **Kimo**
Manufacturer :

Type : **MP210**
Type :

N° de série : **1D220204311**
Serial Number :

N° Inventaire :
Inventory Number :

Ce certificat comprend **3** page(s)
The certificate includes

Date : **28 février 2022**

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Responsable Métrologie
Metrology Manager
Sabrina LUTAUD

P.O. Aurélie DELEMME

Service Laboratoires

Sauermann Industrie S.A.S
ZA Bernard Moulinet - Rue Koufra
24700 Montpon-Ménestérol - France

+33 (0)5 53 80 85 00
services@sauermanngroup.com

www.sauermann.fr

S.A.S au capital de 11 992 050 € - RCS Périgueux 391 699 311 - SIRET 391 699 311 00034 - APE 2813Z - n° TVA : FR 78 391 699 311

ETALONNAGE EN PRESSION
PRESSURE CALIBRATION

1- Caractéristiques de l'appareil :
Instrument features :

Désignation : Thermo-anémo-manomètre MP210
Description : Thermo-anemo-manometer MP210

Avec entrée de pression sur module interchangeable
With pressure interchangeable measurement module

N° série sonde / *Probe S.N. :* 1D220202182 N° inventaire sonde / *Probe I.N. :*

Echelle : -10000 à 10000 Pa Résolution : 1 Pa
Range : *Resolution :*

2- Méthode d'étalonnage :
Calibrating principles :

Les points d'étalonnage sont réalisés par comparaison avec les moyens suivants:
- MP014 Banc de génération de pression dynamique, plage d'utilisation de 0 à 2 bar,
- ETP 108 étalon n°:5F170807181, certificat d'étalonnage n°TSMO2203377,
- ETP 109 étalon n°:5F171108012, certificat d'étalonnage n°TSMO2203386, contrôlé(s) avec la référence ETP 030 n°:17402G40/001705787, raccordé(s) aux étalons nationaux par le certificat COFRAC n°P2109488O et l'étalon ETP 031 n°:17402G40/010604006, raccordé(s) aux étalons nationaux par le certificat COFRAC n°P2108298P et l'étalon ETP 045 n°:G18728G40/016080435, raccordé(s) aux étalons nationaux par le certificat COFRAC n°P2109498O.

The points of calibration are realized with means of calibration according to:
- MP014 Bench generator dynamic pressure, measuring range 0 to 2 bar,
- ETP 108 a standard sn°:5F170807181, calibration certificate n°TSMO2203377,
- ETP 109 a standard sn°:5F171108012, calibration certificate n°TSMO2203386, controlled with standard ETP 030 sn°:17402G40/001705787, traceable to standard national reference by COFRAC certificate n°P2109488O and typeETP 031 sn°:17402G40/010604006, traceable to standard national reference by COFRAC certificate n°P2108298P and typeETP 045 sn°:G18728G40/016080435, traceable to standard national reference by COFRAC certificate n°P2109498O.

3- Conditions d'environnement :
Environmental conditions :

Température ambiante : 21,8 °C Humidité relative : 31,5 %HR Pression atmosphérique : 1013 hPa
Ambient temperature : *Relative humidity :* *Atmospheric pressure :*

4- Remarques :
Remarks

Néant

5- Résultats des mesures :
Measurement results :

n°	Vref	Unit	Vi	Unit	Vi-Vref	Unit	Incertitude
1	99,4	Pa	100	Pa	0,600	Pa	0,674
2	1000	Pa	1001	Pa	1,000	Pa	1,358
3	2496	Pa	2501	Pa	5,000	Pa	3,533
4	5000	Pa	5001	Pa	1,000	Pa	6,370
5	9989	Pa	9987	Pa	-2,000	Pa	10,135

ETALONNAGE EN PRESSION
PRESSURE CALIBRATION

Vref: valeur lue sur l'appareil étalon, Vi: valeur lue sur l'appareil du client.L'unité de l'incertitude de mesure est exprimée dans la même unité que Vref. Les incertitudes mentionnées prennent en compte les incertitudes de l'étalonnage (étalon de référence, moyen, condition d'environnement, résolution de l'appareil ...). Ces incertitudes sont élargies avec un coefficient k=2.

Vref: value displayed by our reference instrument, Vi: value displayed by customer's instrument.For uncertainty, unit is the same as the one of Vref. Uncertainties above mentionned take into account calibration uncertainties (reference instrument, calibration mean, environment conditions, instrument resolution...). These uncertainties are extended with coefficient k=2.

Etalonnage effectué par Faure Sébastien **le** 24/02/22
Calibration performed by

TETRA TECH

Certificat d'étalonnage

Manufacturier :	Landtec	No. du certificat :	GEM5K-240322-TT
No. du modèle :	GEM5000	Type :	5 gaz
No. de série :	G501761	Cellules de détection :	CH_4, CO_2, O_2, CO, H_2S
Date de calibration :	24-03-2022	Calibration par :	Marc-André Brouillard, ing

Étalonnage				
Air ambiant				
Cellule de détection	**Lecture**			
	Initiale	**Visée**	**Action**	**Finale**
Méthane (CH_4) (%v/v)	-0.1	0.0	calibré	0
Dioxyde de carbone (CO_2) (%v/v)	0.1	0.0	calibré	0
Oxygène (O_2) (%v/v)	20.3	20.9	calibré	20.9
Monoxyde de carbone (CO) (ppmv)	-1.0	0	calibré	0

Gaz certifiés								
Type	**Lot**	**Part**	**Précision**	**Exp.**	**Lecture**			
					Visée	**Initiale**	**Action**	**Finale**
Méthane (CH_4) (%v/v)	9-276-781	H197150vm2	±2%	05/2023	50.0	49.4	calibré	50.0
Dioxyde de carbone (CO_2) (%v/v)					35.0	35.2	calibré	35.0
Azote (N_2) (%v/v)					15	14.8	calibré	15.0

Signature :	Date : 24-03-2022

Tetra Tech QI inc. | Environnement
1205, rue Ampère, bureau 310, Boucherville (Québec), Canada J4B 7M6 | tetratech.com

ANNEXE B : FICHE TECHNIQUE DU DÉBITMÈTRE DU PROJET

FLUID COMPONENTS INTERNATIONAL LLC
www.FluidComponents.com
1755 La Costa Meadows Drive, San Marcos, CA 92078-5115
(760)744-6950 (800)854-1993 FAX: (760)736-6250

Model ST98 Flowmeter

CALIBRATION CERTIFICATE

AVENSYS SLOUTIONS

Customer Order Number:	RA380161	Part Number:	ST98-11CT012AWFA
Serial Number:	413922-A	FCI Calibration Procedure:	19EN000020 Rev. C
Purchase Order Number:	N/A	Local Tag #1:	N/A
Customer Flow Range:	50 to 500 NCMH	Local Tag #2:	N/A
Customer Line Size:	147.3 mm i.d. (inside dia)	Local Tag #3:	N/A
Customer Temperature Range:	0 to 50 deg C	Remote Tag #1:	N/A
Customer Pressure Range:	-6.5 to 0 KPa(g)	Remote Tag #2:	N/A
Customer Installation:	Horizontal / Side / Right to Left	Remote Tag #3:	N/A
Customer Standard Conditions:	0 deg C and 1.01325 Bar(abs)		
Customer Actual Media:	Digester Gas: Methane 45%, Carbon Dioxide 40%, Nitrogen 13%, Oxygen 2% (Vol%)		
FCI Calibration Media:	Methane 44.95%, Carbon Dioxide 41.28%, Nitrogen 13.76%		

Output Information

Output: 4-20 mA = 0 to 500 NCMH (step = 50 NCMH @ 5.600 mA)

Calibration Equation: NCMH = 31.25 x mA - 125

Calibration Notes

- *Calibration performed using equipment traceable to N.I.S.T. (US National Institute of Standards and Technology) and ISO/IEC 17025, International Standards for Test lab Quality systems.*
- *Substitute gas and gas equivalency used for calibration.*

Final Flow Verification performed on 100 psig Bypass Stand

Desired NCMH Per Stand	Model ST98 Indicated NCMH	Actual % Reading Difference	Allowed % Reading Difference
129	127.8	-0.92	±2.94
252.3	251.3	-0.40	±1.99
377.8	375	-0.74	±1.66
502.1	499.1	-0.60	±1.50

N.I.S.T. Traceable Equipment: 100 psig Bypass Stand

Calibration Control Number	Calibration Date	Calibration Due date	Equipment Description
EL-329	8-Sep-16	8-Sep-17	Freq. Counter (Bypass)
EL-509	8-Sep-16	8-Sep-17	Freq. Counter (Master)
EL-823	23-Jan-17	23-Jan-18	HP Data Acquisition Unit
FM-085	27-Feb-17	27-Aug-17	4" Turbine Meter
FM-095	6-Mar-17	6-Sep-17	4" Turbine Meter
PG-045	9-Sep-16	9-Sep-17	Pressure Gauge
PG-163	12-Apr-17	12-Oct-17	Pressure Transducer (Master)
PG-175	12-Apr-17	12-Oct-17	Pressure Transducer (Bypass)
TE-018	19-Jan-17	19-Jan-18	Temperature RTD (Bypass)
TE-087	19-Jan-17	19-Jan-18	Temperature RTD (Master)

Technician: P. Bell (210)

Calibration Date: 07-24-17

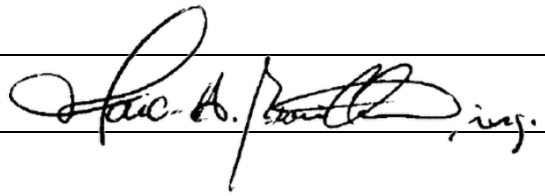
Certificat d'étalonnage

Manufacturier :	ExTox, (Gasmess Système GmbH)	No. du certificat :	ExTox-RT-24032022
No. du modèle :	ET-4D2	Cellules de détection :	CH_4
No. de série :	B11-511714-004	Calibré par :	Marc-André Brouillard, ing.
Date de calibration :	24 mars 2022	Titre :	Chef d'équipe

Lectures	
Landtec GEM5000	
No. de série :	G501761
Dernière calibration :	24 mars 2022
Méthane (CH_4) :	52.0% (moyenne 5 lectures)
ExTox ET-4D2	
Méthane (CH_4) :	51,3% (moyenne 5 lectures)

Type de calibration	
Gaz en place	☑
Gaz certifié	☐

Étalonnage analyseur de méthane (CH_4) ExTox ET-4D2
Ce document certifie que l'analyseur de méthane ExTox-4D2, no. de série B11-511714-004 a été vérifié et que les valeurs mesurées se situent dans la plage normale de tolérance de l'équipement (± 2%). L'étalonnage de l'analyseur de méthane a été effectué en opération normale, directement sur la conduite principale de biogaz soutiré du lieu d'enfouissement, et dans des conditions de pression et de température correspondants à celles du système.

Signature : 	Date :24-03-2022

Annexe 11 – Calcul des réductions d’émissions de GES

Terreau Biogaz SEC - Destruction du biogaz au LES de Granby [LE014 - 14178TTN] Période 2021-2022

Volume journalier de CH_4 capté et détruit (m^3/d)

et bilan de la réduction des émissions de GES (t-éq.CO_2)

	Débit journalier de méthane collecté (Nm^3-CH_4/d)								
	juil-21	août-21	sept-21	oct-21	nov-21	déc-21	janv-22	févr-22	mars-22
1	Hors période de projet	1 917.2	1 909.3	2 137.3	2 208.7	2 168.6	2 038.8	1 908.3	1 983.2
2		1 865.0	1 982.3	2 161.0	2 260.9	2 223.4	2 004.2	1 737.1	1 813.5
3		1 894.1	1 989.0	2 145.4	2 255.9	2 001.1	1 976.5	1 641.1	1 736.2
4		1 881.9	1 962.7	2 107.2	2 106.2	2 035.5	2 352.5	1 734.5	1 823.1
5		1 890.4	2 005.1	2 042.5	2 236.7	1 934.1	2 106.1	1 567.6	1 845.4
6		1 888.3	1 995.6	2 095.5	2 246.1	1 988.9	1 951.7	1 648.3	1 911.9
7		1 894.5	1 983.2	2 020.2	2 231.0	1 931.6	1 955.7	1 892.0	1 869.5
8		1 865.0	2 044.5	2 185.1	2 185.7	2 096.6	1 884.1	1 984.7	1 771.5
9		1 920.6	2 023.6	2 191.6	2 096.4	1 979.7	2 129.5	1 853.5	1 897.6
10		1 890.6	1 926.6	2 194.3	2 066.5	2 130.2	1 737.6	1 825.7	1 746.4
11		1 850.2	1 878.0	2 141.4	1 903.0	1 854.2	1 392.6	1 841.3	1 779.5
12		1 897.6	2 092.2	2 142.9	2 152.9	752.7	2 146.8	1 836.6	1 766.4
13		1 848.0	2 036.3	2 143.1	2 234.7	2 215.2	2 036.9	1 890.0	1 649.8
14		1 826.4	2 097.1	2 093.3	2 096.3	2 052.7	1 957.8	1 787.1	1 535.6
15	1 826.9	1 871.9	2 006.5	2 093.1	2 057.2	2 243.2	1 581.4	1 806.5	1 492.8
16	1 817.7	1 935.3	1 980.1	2 027.6	1 940.7	2 340.8	1 792.3	1 998.0	1 714.5
17	1 791.7	1 992.5	2 092.6	1 918.5	2 065.1	2 135.8	2 232.1	1 766.9	1 880.0
18	1 823.1	1 903.6	2 027.1	1 525.0	2 135.2	2 053.3	1 787.1	1 802.0	1 858.4
19	1 821.3	2 024.1	2 083.8	2 264.6	2 066.8	1 917.8	2 029.4	1 837.4	1 943.5
20	1 868.4	1 942.5	2 075.5	2 215.0	2 136.0	1 825.5	1 781.0	1 798.8	1 802.3
21	1 837.7	1 918.5	2 020.9	2 238.5	2 193.2	2 176.5	868.7	1 738.6	1 725.1
22	1 854.4	1 913.2	2 021.9	2 158.1	2 166.9	2 174.3	2 048.4	1 907.4	1 620.4
23	1 873.3	1 897.7	2 064.0	2 184.7	2 074.2	1 822.4	2 216.9	1 807.0	1 550.5
24	1 888.2	1 879.7	2 139.7	2 145.2	2 072.3	2 118.7	1 954.4	1 820.0	1 589.8
25	1 971.3	1 868.6	2 171.5	2 152.7	2 199.6	2 260.5	1 828.8	1 765.3	1 691.4
26	1 858.4	1 869.1	2 167.5	2 277.5	2 141.1	2 004.2	1 468.0	1 694.5	1 619.7
27	1 835.9	1 846.0	2 048.6	2 203.3	2 097.9	2 098.8	1 762.3	1 789.3	1 520.3
28	1 881.9	1 284.2	2 142.0	2 198.2	2 107.4	2 148.7	1 718.4	1 359.5	1 412.9
29	1 977.3	1 988.7	2 117.0	1 994.7	2 072.6	2 105.5	1 949.2		1 412.0
30	1 888.6	1 937.6	2 087.5	2 187.1	1 976.2	2 079.6	1 509.2		1 510.3
31	1 932.0	1 950.2		2 429.2		2 028.5	1 541.4		1 480.9

											Total période 2021-2022
Débit mensuel de méthane collecté (Nm^3-CH_4)	Q	[Éq. 6]	31 748	58 353	61 172	66 014	63 783	62 898	57 740	50 039	52 955	504 702
Efficacité de destruction	ED		0.936	0.936	0.936	0.936	0.936	0.936	0.936	0.936	0.936	Moteur à combustion interne
Quantité de CH4 valorisé ou détruit (t-CH_4)	$CH_{4V\text{-}D}$	[Éq. 4]	19.85	36.49	38.25	41.28	39.88	39.33	36.10	31.29	33.11	315.6
Facteur d'oxydation du CH_4 par les bactéries du sol	OX	[Éq. 3]	10%	10%	10%	10%	10%	10%	10%	10%	10%	Pas de membrane
PRP du méthane (t-CO_2e/t-CH_4)			25	25	25	25	25	25	25	25	25	Selon Règlement
Émissions de GES du scénario de référence (t-CO_2e)	ÉR	[Éq. 2]	446.6	820.9	860.6	928.7	897.3	884.9	812.3	704.0	745.0	7 100
Émissions de GES du scénario de projet (t-CO_2e)	ÉP	[Éq. 9]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Réductions d'émissions de GES (t-CO_2e)	**RÉ**	[Éq. 1]	446.6	820.9	860.6	928.7	897.3	884.9	812.3	704.0	745.0	**7 100**
										Promoteur (97%)		*6 887*
										Fonds vert (3%)		*213*

Annexe 12 – Preuve de vente d’électricité

Terreau Biogaz, s.e.c.
1327, avenue Maguire, bureau 100
Québec Qc G1T 1Z2 Canada
Téléphone : 418-476-1686
Télécopieur : 418-476-1687

Facture : 18000183
Date : 2022-04-01

Facturé à : **Hydro-Québec**
agissant à travers sa division Hydro-Québec Distribution
Complexe Desjardins, tour Est, 24e étage
C.P. 10000, succ. Place Desjardins
Montréal, QC H5B 1H7

Notre dossier: **15503J** / 1152
Courriel: gaetan.dube@groupeth.com
Tél.: (418) 476-1686
Informations bancaires:
-Caisse populaire Desjardins de Charlesbourg
-#compte: 212589-6
-#Institution: 815 - #Transit: 20030

À l'attention de ***Madame Geneviève Dupuis "514 879-4100 (5850) »***
Conseillère Planification et Contrôle II

PRODUCTION D'ÉNERGIE - ANNÉE 2022

Période : 1er mars au 31 mars 2022

Énergie totale produite : 1455,692 MWh

Énergie facturée : 1433,621 MWh x 153,0112$ = **219 360.07**$

Notre projet	15503J	Approvisionnement électricité Centrale de Cogénération de la Haute-Yamaska-Roland Thibault
Notre sous-projet	000	Électricité MES (art. 14.1) (148,91605 x 1,0275 = 153,0112)

	À ce jour	Précédent	Cette facture
Honoraires	**615 902,88$**	**396 542,81$**	**219 360,07$**
Total du sous-projet	**615 902,88$**	**396 542,81$**	**219 360,07$**
Montant total	**615 902,88$**	**396 542,81$**	**219 360,07$**
TPS 5.0% - 843792656			**10 968,00$**
TVQ 9.975% - 1215792940			**21 881,17$**

Grand total **252 209,24$**

Paiement net 21 jours

S.V.P. envoyez avis de dépôt: admin@terreau.ca