

BASI DI PROGETTO E RELATIVI ALLEGATI

ALLEGATO 25 DEL SIA

IMPIANTO SMALL SCALE LNG PLANT

Collesanto gas field

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FRASCOGNA STEVEN MARK
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Di Luca
Francesco
Ordine degli
Ingegneri della
Provincia de
L'Aquila
Ingegnere
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SMALL SCALE LNG PLANT

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1. INTRODUZIONE

La presente relazione ha lo scopo di descrivere le basi di progetto per la realizzazione e l'esercizio dell'impianto Small Scale LNG per la produzione di Gas naturale liquefatto (LNG) prodotto dai pozzi Monte Pallano 1 Monte Pallano 2 (di seguito MP-1 e MP-2) nel territorio del comune di Bomba (CH – Regione Abruzzo).

Tali pozzi afferiscono all'Istanza di Concessione di coltivazione in terraferma Colle Santo, di cui, nella Tabella 1-1 seguire, di riportano le principali informazioni.

TABELLA 1-1: ISTANZA DI CONCESSIONE DI COLTIVAZIONE “COLLE SANTO”		
Operatore	LNEnergy Srl (già CMI Energia Srl)	
Estensione	35,72 km ²	
Comuni interessati	Archi, Atessa, Bomba, Pennadomo, Roccascalegna, Torricella Peligna, Villa Santa Maria, Colledimezzo	
COORDINATE GEOGRAFICHE DEI VERTICI		
a	1° 54'	42° 04'
b	1° 56'	42° 04'
c	1° 56'	42° 00'
d	1° 52'	42° 00'
e	1° 52'	42° 03'
f	1° 54'	42° 03'

1.1 Motivazioni dell'intervento

Per la produzione dei pozzi di Monte Pallano 1 e Monte Pallano 2 sono state individuate in via preliminare diverse soluzioni tecniche, in linea con le più moderne tecnologie di trattamento e valorizzazione del gas attualmente presenti nel mercato dell'industria di processo, considerando la posizione geografica dei pozzi stessi e la presenza o assenza di infrastrutture esistenti adiacenti all'area dei pozzi.

La soluzione tecnica scelta prevede un tipo di impianto adatto alla produzione di LNG e al suo stoccaggio in loco per la successiva vendita e distribuzione sul mercato locale e nazionale.

La tecnologia identificata è definita con il termine di "Small Scale LNG", ossia la produzione di LNG su piccola scala, configurandosi come una soluzione efficiente, svincolata dall'approvazione e costruzione di infrastrutture ausiliarie esterne all'impianto e in linea con le strategie energetiche nazionali.

La coltivazione dei pozzi MP-1 e MP-2, già perforati, ha lo scopo di produrre il gas presente nella struttura anticlinale mineralizzata. La capacità produttiva di design dei pozzi in questione è stata stimata essere pari a 283.013 Std m^3 /giorno (268.280 Nm ^{3} /giorno).

Di seguito la composizione del Gas Grezzo proveniente dai pozzi e i dati caratteristici:

Metano	69.14%
Etano	4.94%
Propano	2.24%
i-butano	0.34%
n-butano	0.51%
i-pentano	0.12%
n-pentano	0.10%
n-esano	0.13%
n-eptano	0.06%
n-ottano	0.00%
n-nonano	0.00%
elio	0.11%
CO ₂	0.70%
H ₂ S	0.27%
N ₂	21.34%

Densità relativa	0.717
Potere cal. Sup. PCS	33102 MJ/mc
Wobbe Index	39092 MJ/mc
Equivalenza gas commerciale a 38.1 MJ/Smc	0.869 mc/Smc

1.2 Profilo di produzione previsto

Di seguito viene riportato il profilo di produzione e gli scenari basati sulla relazione di studio del campo "Valutazione di Colle Santo Gas Project, Italia come a settembre 30, 2022", preparato per conto della Committente - Re-lease finale di ottobre 26, 2022 No. 218221 da RPS GROUP, per quanto riguarda la produzione prevista dai SOLI due pozzi esistenti MP1- & MP-2.

Reserves Category	Oil (MMstb)	Gross Reserves Sales Gas NGL& C5+ (Bscf) (MMbbl)	BOE (MM bbl)	il (MMstb)	Net Reserves Sales Gas NGL& C5+ (Bscf) (MMbbl)	BOE (MMbbl)
PROVED	-	56.8	-	9.5	-	45.7
PROVED + PROBABLE	-	65.3	-	10.9	-	51.7

Le previsioni di produzione del gas grezzo del giacimento di Colle Santo sono state riassunte nel seguente diagramma.

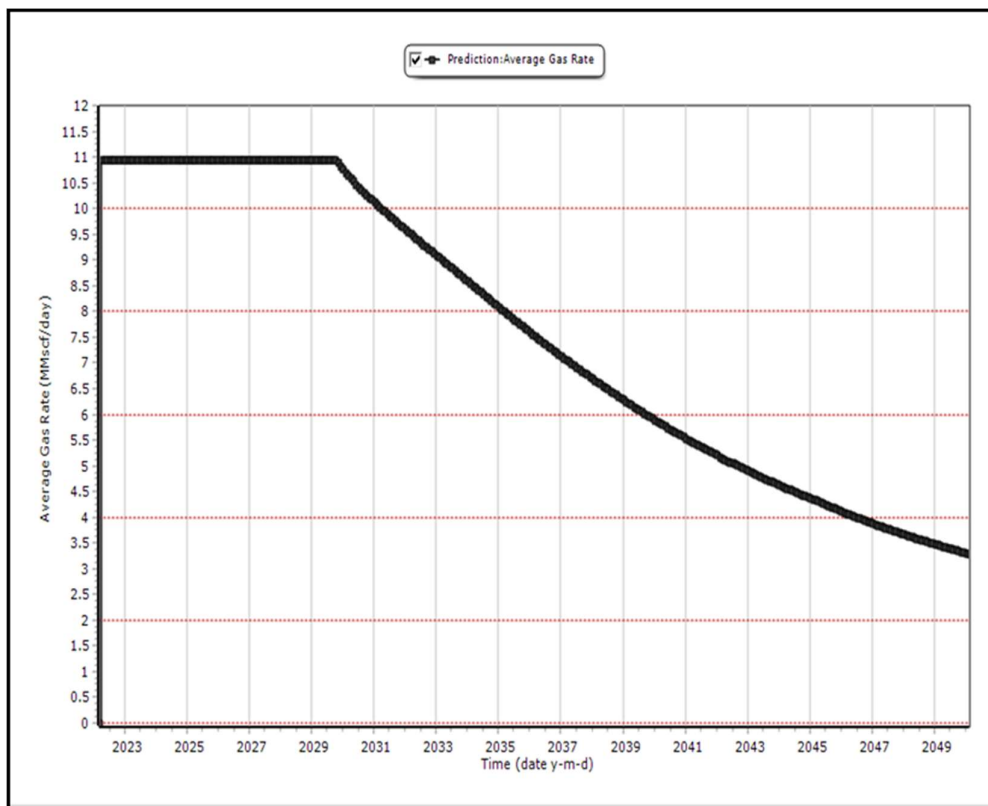


FIGURA 1-1: TASSO DI PRODUZIONE ANNUALE MEDIA DEL GAS

A partire dall'erogazione di gas grezzo dai due pozzi esistenti MP1- e MP-2, alla tecnologia innovativa di Small Scale LNG per la produzione di LNG, si aggiunge anche la cattura di CO₂ (1400 tonnellate di equivalente CO₂ all'anno), e il relativo recupero, Purificazione e Imbottigliamento, la Generazione di Energia mediante ossi-combustione e l'utilizzo di idrogeno finalizzata all'autosufficienza termini di consumi elettrici e di energia, il tutto sulla base della filosofia di progettazione Zero-Liquid Discharge (ZLD). Di seguito sono stati riassunti i profili di produzione in termini di LNG e Recupero di CO₂.

FASE	NR	ANNO	GAS ESTRATTO	PRODUZIONE LNG	CO ₂ CATTURATA
			BCF/ANNO	TONN/ANNO	TONN/ANNO
Operazioni di funzionamento dello Small Scale per 20 anni	1	2025	3.09	44324	1208
	2	2026	3.38	48570	1321
	3	2027	3.37	48438	1317
	4	2028	3.37	48438	1317
	5	2029	3.37	48437	1317
	6	2030	3.38	48570	1321
	7	2031	3.37	48437	1317
	8	2032	3.23	46389	1263
	9	2033	2.91	41816	1138
	10	2034	2.69	38685	1052
	11	2035	2.48	35615	970
	12	2036	2.29	32851	895
	13	2037	2.11	30305	825
	14	2038	1.95	28041	762
	15	2039	1.8	25834	704
	16	2040	1.67	23940	653
	17	2041	1.55	22265	606
	18	2042	1.45	20841	567
	19	2043	1.36	19467	532
	20	2044	1.36	19467	532
	21	2045	1.36	19467	532
	22	2046	1.36	19467	532

1.3 Filosofia operativa

Negli ultimi anni il Mercato del Gas è stato al centro di numerosi e profondi cambiamenti che hanno visto il GNL diventare un'opzione sempre più importante sia per il trasporto marittimo e terrestre sia per altri usi, nel contesto della transizione energetica improntata alla sostenibilità e a una low carbon economy.

Difatti il gas naturale liquefatto ha acquisito sempre maggiore importanza nel soddisfacimento dei fabbisogni energetici, in primo luogo grazie alla necessità di diversificazione delle forniture in previsione di future crisi politiche e in questo, per sua natura e modalità di trasporto, l'LNG rappresenta una modalità di approvvigionamento flessibile rispetto ai gasdotti di norma vincolati ai paesi esportatori e a quelli attraversati. A tutto ciò si somma l'abbattimento dei costi derivante dall'evoluzione tecnologica, specialmente nei processi di liquefazione che hanno reso la tecnologia del GNL sempre più competitiva sul mercato.

L'utilizzo del GNL risulta inoltre coerente con la Strategia Energetica Nazionale (SEN) che promuove gli interventi necessari per continuare ad assicurare un'adeguata ed economica disponibilità di gas, con l'obiettivo di allineare i prezzi e costi dell'energia a quelli europei assicurando che la transizione energetica prevista per il ventennio 2030-2050 non comprometta la competitività industriale italiana ed europea. Altri obiettivi cardine della SEN in relazione al GNL riguardano il raggiungimento degli obiettivi definiti nel Pacchetto Europeo Clima – Energia 2020 e la diversificazione di fonti/approvvigionamento/logistica.

A livello comunitario, la Commissione Europea, con la direttiva 2014/94/EU sullo sviluppo dell'infrastruttura per i combustibili alternativi (DAFI), recepita nel nostro ordinamento con il decreto legislativo 16 dicembre 2016, n. 257, ha previsto che gli Stati Membri producano piani di sviluppo delle diverse fonti alternative per il settore dei trasporti entro il 2016. In tale contesto si colloca anche il GNL, per il quale la direttiva prevede che, attraverso i rispettivi quadri strategici nazionali, gli Stati Membri assicurino che entro il 31 dicembre 2025 venga realizzato un numero adeguato di punti di rifornimento per il GNL nei porti marittimi appartenenti alla rete centrale TEN-T (*"Trans-European Transport Network"*) ed entro il 31 dicembre 2030 nei principali porti della navigazione interna.

Il Governo Italiano si è impegnato, in sede parlamentare, ad adottare iniziative per la realizzazione di centri di stoccaggio e ridistribuzione nonché norme per la realizzazione dei distributori di GNL per incentivarne l'uso e ridurre così l'impatto ambientale dei trasporti via mare e su strada. Il Ministero dello Sviluppo Economico, attraverso la costituzione di un apposito Gruppo di coordinamento nazionale, ha predisposto una bozza di Piano Strategico Nazionale sull'utilizzo del GNL in Italia, che analizza diversi aspetti: quelli normativi, quelli tecnici, quelli economici nonché quelli attinenti alla sicurezza e all'impatto sociale di tale tecnologia nei trasporti marittimi e su gomma, limitatamente al trasporto pesante.

Con il Piano Nazionale Integrato per l'Energia e il Clima (PNIEC), predisposto con il Ministero dell'Ambiente e della tutela del territorio e del mare e il Ministero delle Infrastrutture e dei Trasporti, vengono stabiliti gli obiettivi nazionali al 2030 sull'efficienza energetica, sulle fonti rinnovabili e sulla riduzione delle emissioni di CO₂, nonché gli obiettivi in tema di sicurezza energetica, interconnessioni, mercato unico dell'energia e competitività, sviluppo e mobilità sostenibile, delineando per ciascuno di essi le misure che saranno attuate per assicurarne il raggiungimento.

Il PNIEC è stato adottato in attuazione del Regolamento 2018/1999/UE, e inviato alla Commissione UE a gennaio 2020, al termine di un percorso avviato nel dicembre 2018. Il PNIEC recepisce le novità contenute nel Decreto-legge sul Clima nonché quelle sugli investimenti per il Green New Deal previste nella Legge di Bilancio 2020 e ribadisce il ruolo del GNL all'interno delle 5 Dimensioni in cui è strutturato.

Per quanto concerne la dimensione decarbonizzazione, tra le Politiche e misure volte a conseguire la mobilità a basse emissioni si richiama il D.Lgs. 16 dicembre 2016, n.257, di recepimento della Direttiva DAFI che prevede la crescita di punti vendita eroganti GNL dalle poche decine attuali a circa 800 nel 2030.

Sul fronte efficienza energetica, nell'ottica di favorire lo sviluppo dei veicoli commerciali alimentati con carburanti alternativi, con il D.M. del Ministro delle Infrastrutture 221/2018 sono stati previsti incentivi anche per l'anno 2018 per l'acquisizione di veicoli industriali con motorizzazione alternativa a gas adibiti al trasporto di merci di massa complessiva a pieno carico pari o superiore a 3,5 tonnellate a trazione alternativa a metano CNG, gas naturale liquefatto GNL ed elettrica (full electric).

Un'altra importante misura riguarda l'Introduzione dell'obbligo per le pubbliche amministrazioni, gli enti e le istituzioni da esse dipendenti o controllate, le Regioni, gli enti locali e i gestori di servizi di pubblica utilità da essi controllati, al momento della sostituzione del rispettivo parco autoveicoli, autobus e mezzi della raccolta dei rifiuti urbani all'acquisto di almeno il 25% di veicoli a GNC, GNL e veicoli elettrici ed il passaggio dei punti vendita eroganti GNL dalle poche decine attuali a circa 800 nel 2030.

In relazione alla sicurezza energetica, tra i principali interventi previsti per garantire l'adeguatezza e il mantenimento degli standard di sicurezza del sistema elettrico, gas e prodotti petroliferi, ci sarà la diversificazione delle fonti di approvvigionamento anche tramite GNL e lo Sviluppo GNL nei trasporti marittimi e servizi portuali.

Per quanto riguarda il mercato interno dell'energia si perseguirà lo sviluppo della rete GNL riconosciuta l'importazione di GNL come fonte di approvvigionamento complementare alle forniture via gasdotto.

Di fondamentale importanza risulta la Cooperazione con altri Stati membri nell'ambito del programma TEN-T per ottimizzare le risorse e i piani complessivi di sviluppo del sistema del GNL per i trasporti stradali.

Nel processo di liquefazione, il gas naturale viene raffreddato a -161°C , riducendo il volume di un fattore 600. Le principali fasi operative di un impianto di liquefazione sono il pretrattamento, la liquefazione, lo stoccaggio e il caricamento su isotank.

Pre-trattamento

L'obiettivo del pre-trattamento è quello di eliminare, dal gas naturale estratto dal pozzo o di origine bio, inquinanti, impurità o idrocarburi più pesanti del metano che potrebbero creare malfunzionamenti all'impianto di liquefazione o solidificare alle basse temperature necessarie allo stoccaggio. Questo permette inoltre di produrre un combustibile conforme alle specifiche del mercato. Questa sezione dell'impianto comprende le unità di rimozione dei condensati, di addolcimento (eliminazione di CO_2 e gas acidi come H_2S), di disidratazione e di rimozione del mercurio

Liquefazione

Durante la fase di liquefazione, il gas naturale viene raffreddato a -161°C attraverso un processo di refrigerazione simile a quello utilizzato dai classici congelatori domestici o dai condizionatori delle nostre auto; esso comprende le fasi di compressione, condensazione ed espansione di uno o un numero superiore di refrigeranti e il loro scambio termico con il gas naturale.

Stoccaggio e carico su isotank

Per immagazzinare il gas naturale in modo sicuro e mantenerlo ad una temperatura di circa -160°C , il sistema di stoccaggio è realizzato con materiali isolanti altamente efficaci che impediscono la trasmissione del calore.

Il sistema di carico del gas liquefatto (2 baie di carico) sarà gestito in modo da consentire il rifornimento di ISO-Container, ovvero cisterne mobili utilizzate come serbatoi criogenici portatili di dimensioni standard.

1.4 Alternative di progetto

Durante la fase preliminare di Scoping, ai sensi art. 20 del Dlgs 152/2006, sono state individuate 2 alternative di progetto per il trattamento ed utilizzo del gas naturale estratto nei due pozzi esistenti MP-1 e MP-2.

In particolare, è stata considerata una prima alternativa denominata *“Staged Development Project”* ed una seconda alternativa denominata *“Small Scale LNG”*, oggetto della presente relazione.

Durante lo sviluppo della procedura preliminare di Scoping e successivamente al pronunciamento della CTVA con proprio Parere No. 601 del 14/11/2022, si è identificata l'alternativa progettuale di Small Scale LNG come quella effettivamente di interesse e, dunque, da assoggettare alla procedura di VIA ai sensi dell'art. 23 del Dlgs 152/2006.

Con riferimento alle tecnologie disponibili di liquefazione del gas naturale, è stata condotta una dettagliata analisi delle varie alternative, come riportata di seguito. Al termine di detta analisi tecnologica e di processo, la soluzione di Small Scale LNG attraverso la tecnologia del *Mixed Refrigerant* è stata valutata come la migliore dal punto di vista tecnico-economico.

Ci sono un certo numero di tecnologie presenti sul mercato che consentono la liquefazione del gas naturale a seconda delle dimensioni dell'impianto che si vuole realizzare.

Le categorie tipiche possono essere classificate come di seguito riportato (Figura 1-2):

- **micro:** capacità inferiore a 0.03mtpa
- **di piccola scala:** maggiore di 0.03 ed inferiore a 0.1mtpa
- **di media scala:** maggiore di 0.1mtpa e inferiore a 2mtpa per treno
- **di grande scala:** maggiore di 2mtpa ed inferiore a 8mtpa per treno¹.

¹ Nota: Gli impianti di liquefazione sono organizzati con unità di lavorazione in parallelo chiamati “treni”, ognuna delle quali tratta una porzione di gas per liquefarlo.

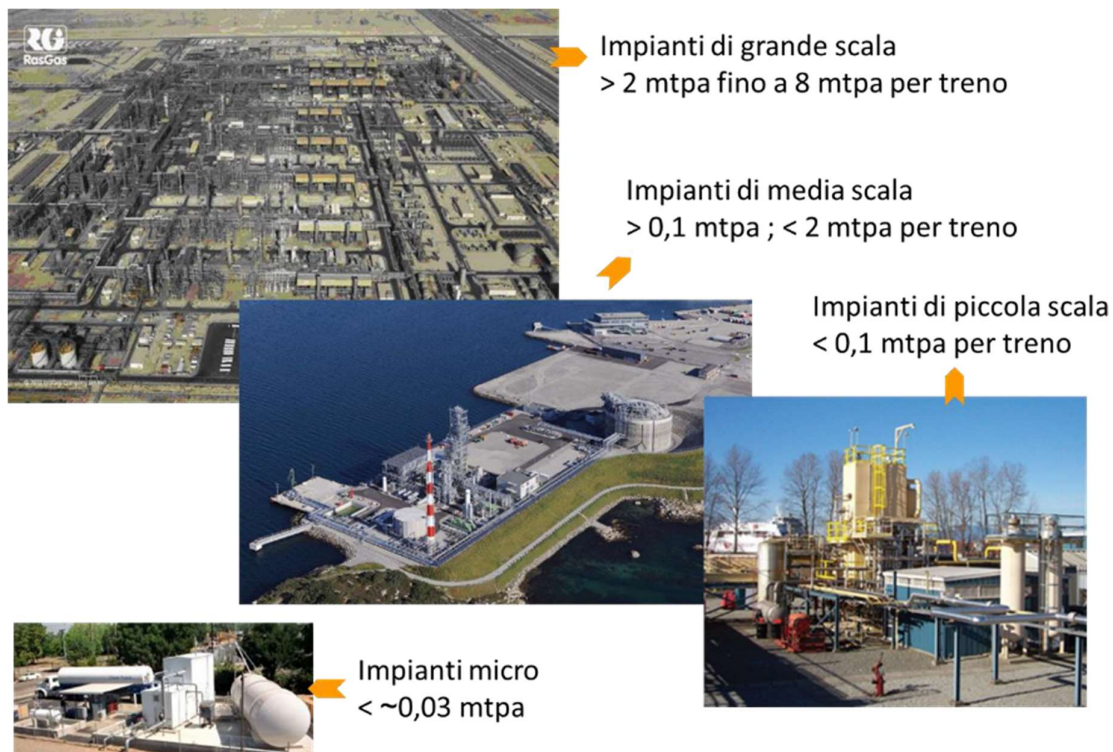


FIGURA 1-2: IMPIANTI PER LA LIQUEFAZIONE DEL GAS (CLASSIFICAZIONE BASATA SULLA CAPACITÀ DI TRATTAMENTO)

I principali processi di liquefazione sono i seguenti:

1. **Metodo di C3-MR:** Il metodo C3-MR è attualmente il metodo principale. Propano e refrigeranti misti (azoto, metano, etano e propano) sono usati come refrigerante (APCI), e un miglioramento su questo metodo chiama il metodo AP-X è utilizzato anche per i grandi impianti di GNL.
2. **Metodo AP-X:** Come i treni di liquefazione diventano più grandi, questi si avvicinano al limite dimensionale dello scambiatore di calore che può essere prodotto e trasportato. Questo processo può aumentare la capacità di produzione di GNL aggiungendo GNL sub-refrigeratori con azoto liquido refrigerante utilizzato secondo il metodo C3-MR, senza aumentare la dimensione dello scambiatore di calore principale (APCI).
3. **Metodo di Cascade:** Questo metodo sequenziale utilizza propano, etilene e metano come liquido di raffreddamento (Phillips).
4. **Metodo DMR:** Questo metodo utilizza due tipi di refrigeranti misti (un mix di etano e propano e azoto-metano, etano e propano mix) (Shell).
5. **Metodo SMR:** Questo metodo è chiamato processo PRICO e utilizza un solo tipo di refrigerante misto (Black & Veatch).
6. **Metodo Bryton nitrogen cycle:** questo metodo utilizza il solo azoto come refrigerante e rappresenta una soluzione soprattutto per gli impianti di liquefazione di piccole dimensioni.

Nella figura seguente si riportano i tipi di tecnologia a seconda della dimensione degli impianti.

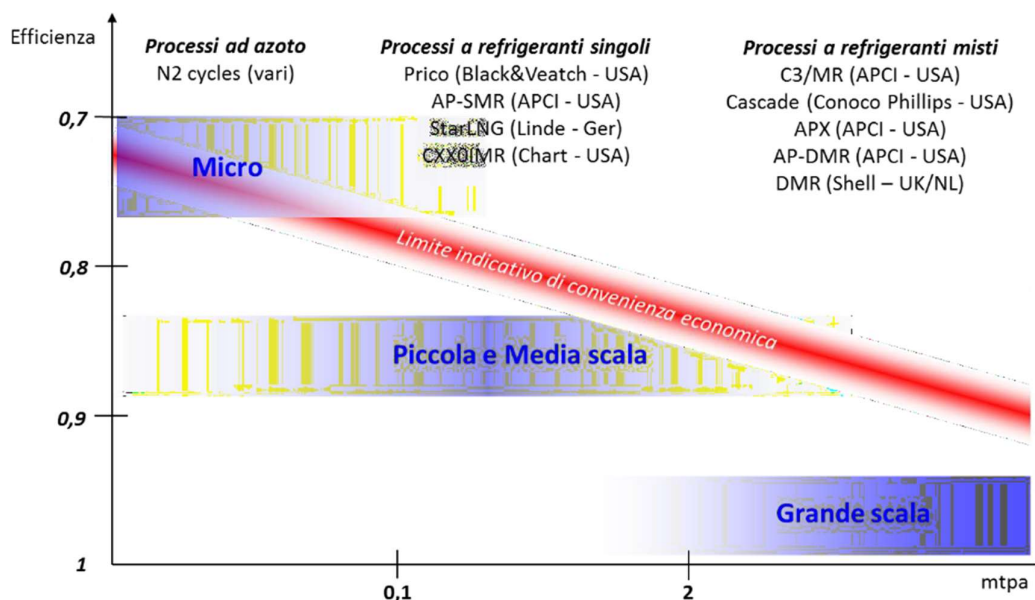


FIGURA 1-3: TECNOLOGIE PER LA LIQUEFAZIONE DEL GAS (CLASSIFICAZIONE BASATA SULLA DIMENSIONE DEGLI IMPIANTI)

Generalmente, all'aumentare della capacità massima di produzione l'efficienza cresce ed i costi di produzione decrescono.

2. INQUADRAMENTO TERRITORIALE

2.1 Descrizione generale dell'area di intervento

L'impianto di Small Scale LNG sarà realizzato nella Regione Abruzzo, in provincia di Chieti, nel territorio del comune di Bomba, attribuibile allo sviluppo del campo di Monte Pallano o alla messa in produzione e coltivazione dei pozzi già presenti Monte Pallano 1 e Monte Pallano 2, afferenti al giacimento di Collesanto, il più grande giacimento di gas onshore non in produzione in Italia.



FIGURA 2-1: FOTO AEREA CON UBICAZIONE AREA DI UBICAZIONE DEGLI ATTUALI POZZI MP1 ED MP2

L'area è ubicata lungo il versante del Monte Pallano, posto a destra del fiume Sangro in Abruzzo, in Provincia di Chieti nel territorio del comune di Bomba a pochi km dal centro abitato. Si trova a circa 1 km in linea retta verso Nord dal lago artificiale di Bomba che caratterizza il comune, creato dallo sbarramento del fiume Sangro (**Figura 2-2**).

Il sito è configurato come una zona scarsamente antropizzata utilizzata principalmente per uso agricolo con una leggera presenza di case e aziende agricole disabitate o utilizzata per scopi puramente temporanei. Lo Small Scale LNG sarà delimitato ad Est dalla S.S. 652 Val di Sangro, da cui sarà creato anche l'accesso all'impianto in congiunzione con quello della diga di Bomba, a nord e ad ovest principalmente da distese boschive e agricole.

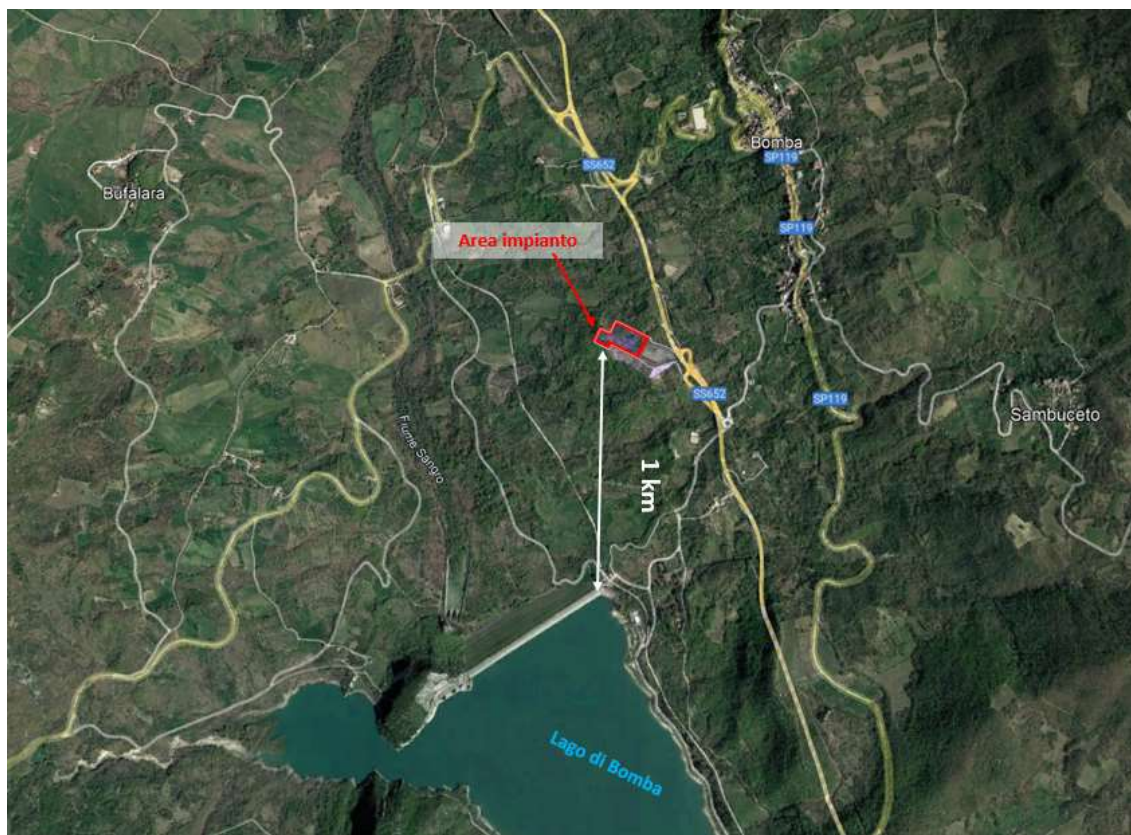


FIGURA 2-2: UBICAZIONE DELL'AREA DI INTERVENTO RISPETTO AL LAGO DI BOMBA

L'impianto Small Scale LNG (in rosso) sarà ubicato esclusivamente nell'area che fiancheggia i pozzi MP-1 e MP-2 e avrà una superficie preliminare di circa 19.200 m² (1,92 ettari) comprese le vie di fuga e di accesso perimetrali. Di seguito è riportata la configurazione preliminare dell'impianto destinato alla liquefazione del gas estratto e alla produzione con stoccaggio in loco del LNG.



FIGURA 2-3: DETTAGLIO AREA DI IMPIANTO E AREA DI CANTIERE SU FOTO AEREA

2.1.1 Viabilità di accesso all'area

La viabilità principale prossima all'impianto è costituita dalla SS652 della Val Di Sandro, a poche decine di metri ad Est rispetto all'area di intervento. La Strada statale è l'arteria principale che collega l'interno del Molise alla costa adriatica attraversando la val di Sangro e terminando nel comune di Fossacesia, in Abruzzo. Questa statale sarà quella che verrà utilizzata per il trasporto del gas liquefatto, per mezzo di autocisterne adibite alla veicolazione, in una qualsiasi destinazione di interesse

A circa 150 m dall'uscita della galleria sulla statale a Sud dell'abitato di Bomba, si diparte la strada di accesso sterrata, che, con direzione Nord – Ovest, giunge sino all'area di impianto. Dalla strada di accesso è possibile costeggiare l'intera area dell'impianto. Nelle figure 2-3,2-4 e 2-5 è riportata la viabilità di accesso e interna all'impianto come sopra descritto.

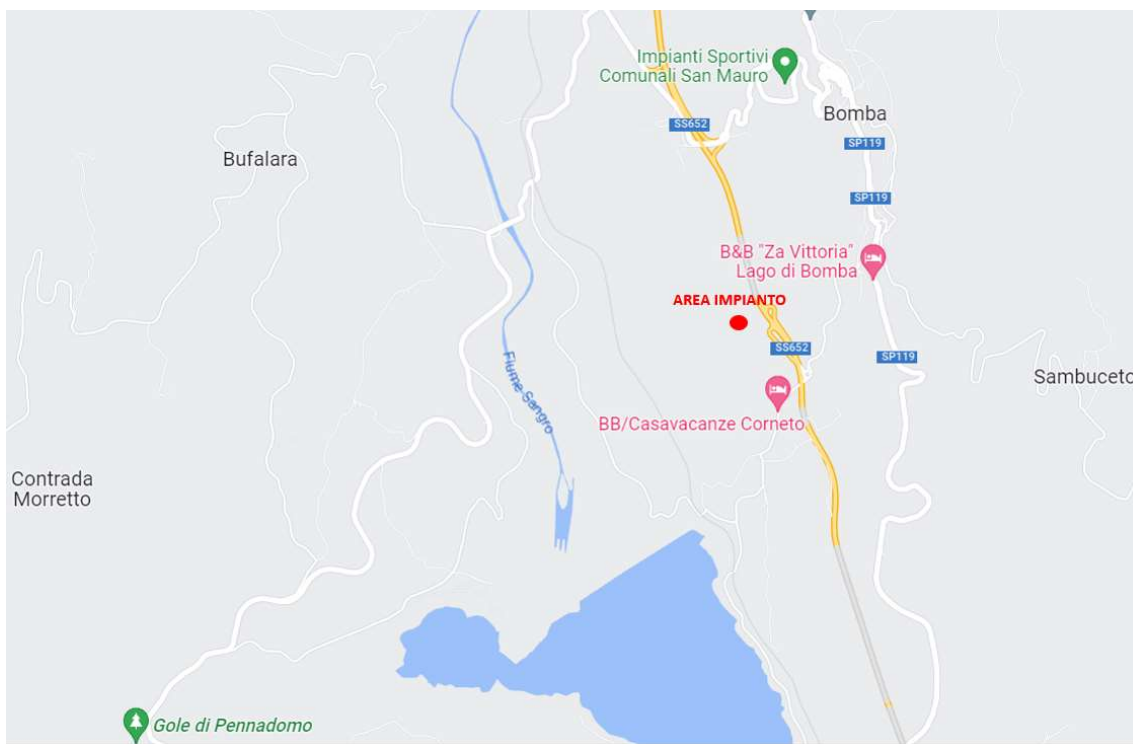


FIGURA 2-4: VIABILITÀ PRINCIPALE NELL'AREA DI PROGETTO (FONTE: GOOGLE MAPS)

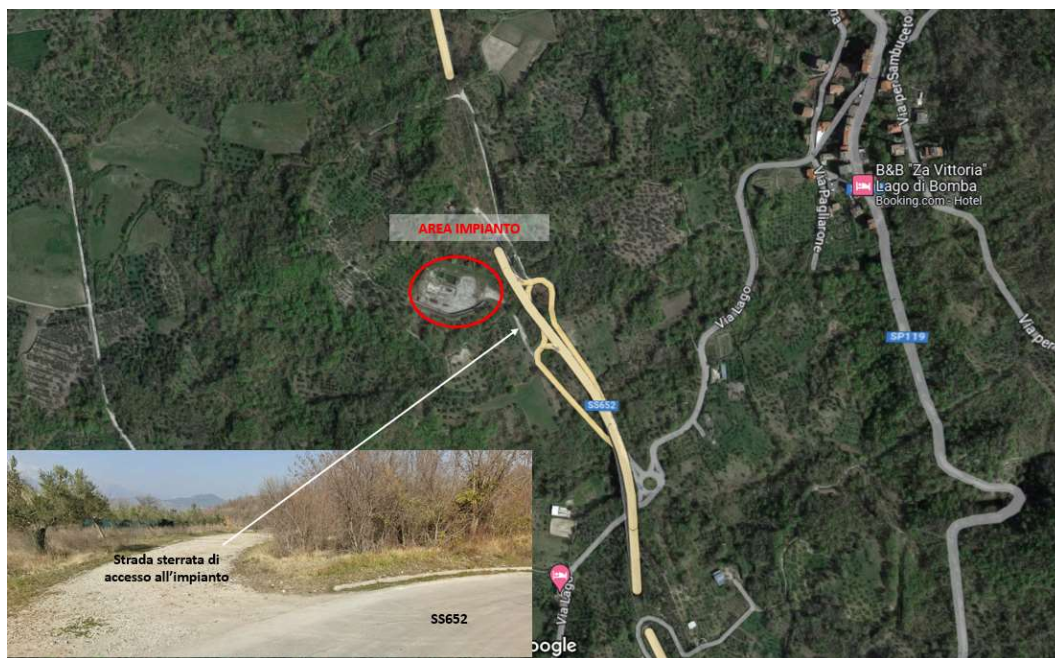


FIGURA 2-5: VIABILITÀ DI DETTAGLIO NELL'AREA DI PROGETTO (FONTE: GOOGLE MAPS)

2.2 Estratto mappa catastale

Catastalmente l'area di impianto ricade nel Foglio di Mappa n. 8 del Comune di Bomba, le particelle catastali sono indicate nella seguente per ciascuna area di intervento (Area Impianto, Area cantiere, viabilità di accesso). In Figura 2-6 si riporta lo stralcio catastale dell'area di intervento.

TABELLA 2-1: PARTICELLE CATASTALI INTERESSATE DALLE AREE DI PROGETTO		
Area di Progetto	Foglio	Mappali
Area Impianto (Sup. 19.200 m ²)	8	1287, 1307, 1310, 1313, 1316, 1317, 1318, 1325, 1336, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1352, 1353, 1355, 1356, 1357, 1358, 1359, 1360, 1362, 1364, 1367, 1368, 1430, 1621
	7	1247, 1248, 1249, 1269, 1270, 1276
Area di Cantiere (Sup. 11.220 m ²)	8	1346, 1347, 1348, 1362, 1363, 1364, 1365, 1366, 1621, 1370, 1373, 1375, 1377, 1378, 1379, 1380, 1381, 1621
Strada di accesso (Sup. 5.520 m ²)	8	1307, 1310, 1316, 1317, 1318, 1325, 1336, 1346, 1347, 1348, 1350, 1352, 1360, 1362, 1363, 1364, 1365, 1370, 1374, 1377, 1379, 1380, 1381, 1621, 1621
	7	1244, 1247, 1248, 1249, 1269, 1270, 1275, 1276



FIGURA 2-6: STRALCIO CATASTALE AREA DI INTERVENTO (IN ROSSO SONO INDICATE LE PARTICELLE CATASTALI CHE INTERESSANO L'AREA DI PROGETTO)

3. CONFIGURAZIONE IMPIANTISTICA DEL NUOVO IMPIANTO SMALL SCALE LNG

Il nuovo impianto Small Scale LNG sarà compatto ed interesserà l'area a Nord della postazione pozzi già esistente Monte Pallano 1-2: la tecnologia Small Scale LNG, infatti, è svincolata dall'approvazione e costruzione di infrastrutture ausiliarie esterne all'impianto.

A seguire si riporta una descrizione delle attività previste nell'impianto e degli item installazioni necessarie presenti. In linea di massima il processo può essere sintetizzato dal diagramma di flusso riportato nella Figura 3-1 e descritto, per fasi, a seguire.

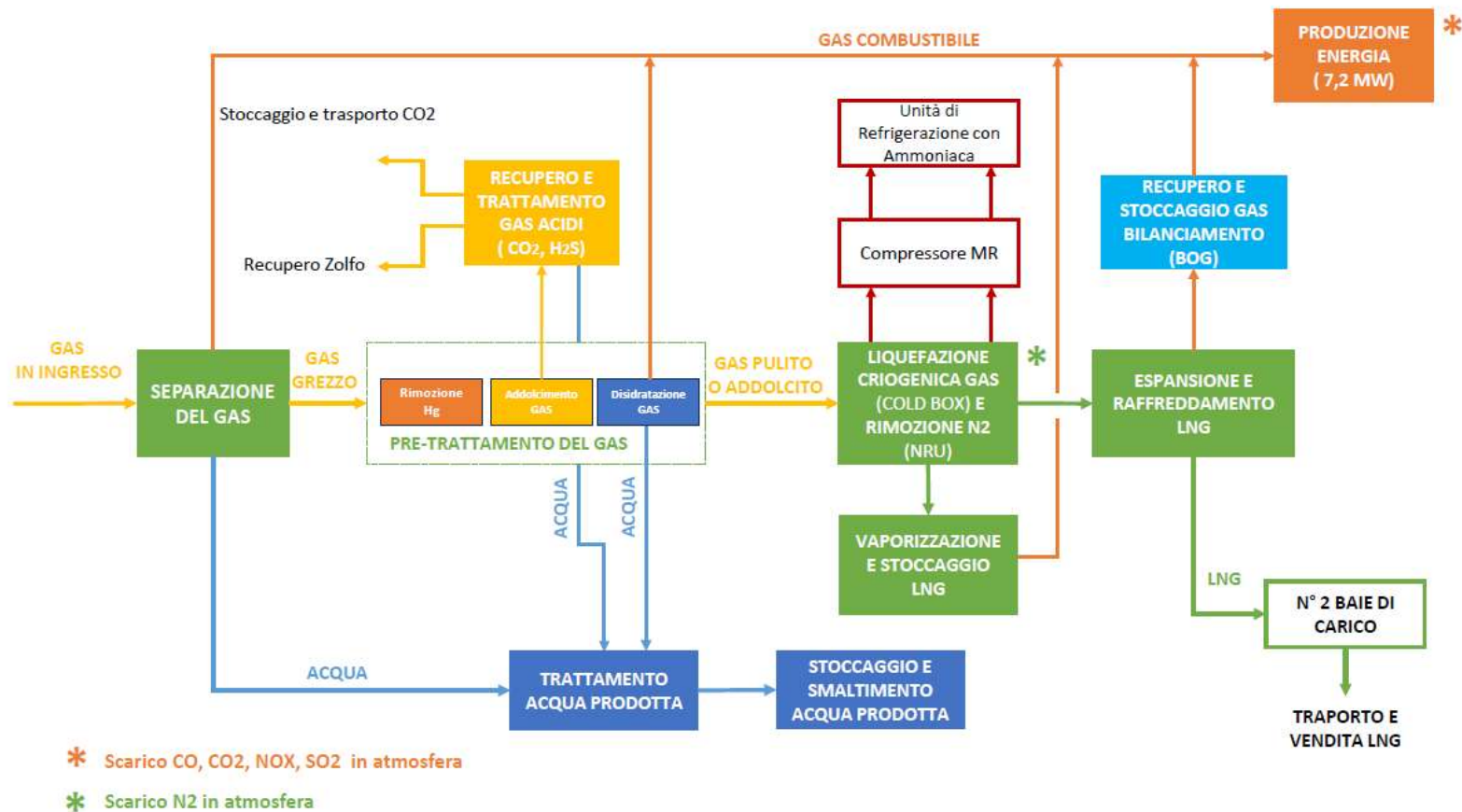


FIGURA 3-1: SCHEMA A BLOCCHI DEL PROCESSO PREVISTO PER LA TECNOLOGIA SMALL SCALE LNG

Le capacità dell'impianto Small Scale LNG in termini di produzione sono riassunte di seguito:

QUADRO SINOTTICO DELLA CAPACITA' DI IMPIANTO DELL'IMPIANTO	
Gas in ingresso	268.280 Nm ³ /giorno (valore medio della portata)
LNG prodotto	134,4 ton/giorno
Funzionamento annuale in continuo	8.000 ore
Capacità di produzione annua di LNG	44.800 ton (capacità media di produzione)
Baie di carico	N°2 baie di carico
Numero di bilici ribassati	N°7 al giorno (per un totale di 14 isotank al giorno, volume di carico di ogni singola cisterna equivalente a 20 m ³)
Consumo di energia elettrica	7,2 MWe
Potenza elettrica installata	Potenza elettrica installata pari a 14,4 MW complessivi ottenuto come autoproduzione all'interno dell'impianto, in cogenerazione con circa 300 ton/giorno di vapore destinato alla generazione addizionale di energia elettrica.

3.1.1 Fase di separazione

Il gas estratto dalle teste pozzo MP-1 e MP-2 è convogliato all'impianto tramite opportune tubazioni. All'ingresso dell'impianto, il gas è caratterizzato dalle proprietà riportate nella tabella a seguire (Tabella 3-1).

TABELLA 3-1: PROPRIETÀ DEL GAS IN ENTRATA ALL'IMPIANTO	
Stima delle quantità in entrata	268.280 Nm ³ /d 283.013 Sm ³ /d
Pressione	50 barg
Temperatura	40,00 °C
% mol N₂	21,32 %
H₂S	2.695 ppmv
CO₂	6.994 ppmv

Il gas proveniente dalle teste pozzo MP-1 e MP-2, dopo addizione di opportuni chemicals (nello specifico inibitori di corrosione, unità 190) è inviato all'Inlet Skid (S-201), contenente il sistema di misura, controllo e sicurezza, facente parte dell'unità 200 (LNG Plant Inlet).

Successivamente, nell'ambito della stessa unità 200, il gas è sottoposto ad una prima fase di separazione all'interno di un separatore orizzontale bifasico V-201 A (Fig.3-2) del volume di circa 20 m³ all'interno del quale si realizza la separazione della fase gassosa dai condensati acquosi in essa contenuti, inviati all'unità di trattamento dell'acqua (unità 530). In uscita dal separatore, il gas è inviato al sistema di rimozione del Mercurio posto a guardia di protezione delle apparecchiature a valle e utilizzando un letto assorbente di materiale certificato (HG Guard Trap V-201 B).

Nelle Figura 3-2 e 3-3 sono mostrati rispettivamente il Separatore bifasico orizzontale e il sistema di iniezione chimici relativamente all'Inibitore di corrosione utilizzato in questa prima fase del processo.

Nella tabella 3-2 è riportato l'elenco e la descrizione delle apparecchiature coinvolte nella fase descritta.

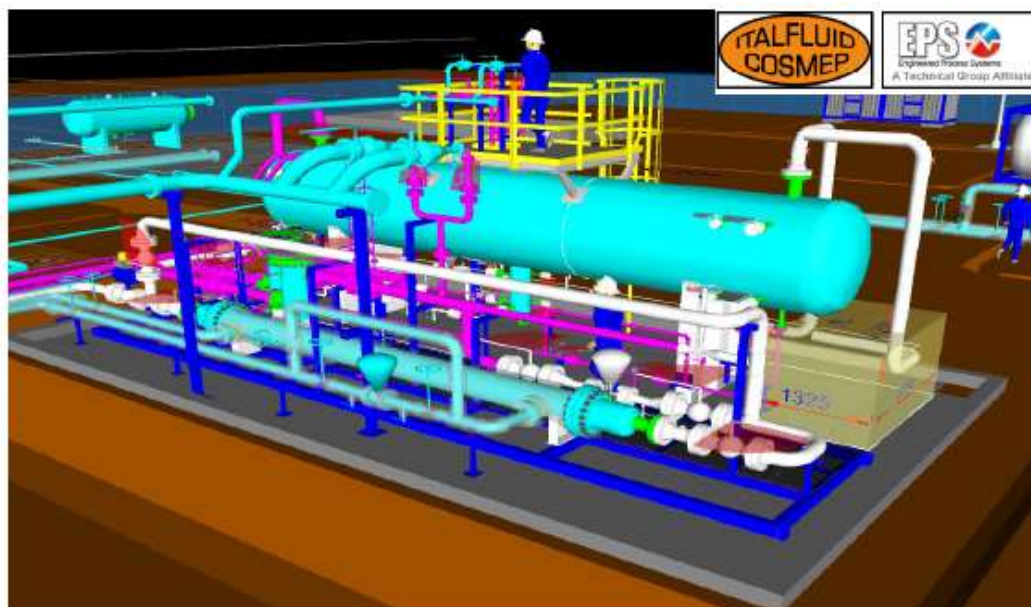


FIGURA 3-2: SEPARATORE ORIZZONTALE BIFASICO V 201-A



FIGURA 3-3: PACKAGE INIEZIONE INIBITORE DI CORROSIONE CI-190-A

TABELLA 3-2: CARATTERISTICHE DELLE APPARECCHIATURE DELLA FASE DI SEPARAZIONE			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
CHEMICAL INJECTION UNIT			
190	CI-190 A	CHEMICAL INJECTION PACKAGE	2,5x3x2,6 1,5 Ton
	CI-190 B	CHEMICAL INJECTION PACKAGE	2,5x3x2,6 1,5 Ton
	CI-190 C	CHEMICAL INJECTION PACKAGE	2,5x3x2,6 1,5 Ton
LNG PLANT INLET (UNIT 200)			
200	S-201	INLET SKID	10x2,3x2,6 25 Ton
	V-201 A	INLET RAW GAS SEPARATOR	10x2,3x2,6 40 Ton
	V-201 B	HG GUARD TRAP	10x2,3x2,6 40 Ton

Dal processo di separazione originano quindi due prodotti:

- **Gas grezzo in uscita dal sistema di rimozione del mercurio**, inviato alle successive operazioni di trattamento addolcimento e disidratazione;
- **Condensati acquosi oleosi** (Oily water) estratti dal fondo del separatore ed inviati all'Unità di trattamento dell'acqua (Unità 530), unitamente ai condensati acquosi provenienti dalle altre unità di processo come ad esempio la disidratazione.

Le correnti collettate all'Unità 530 sono sottoposte a successivi step di separazione e purificazione in cui i condensati acquosi sono epurati delle componenti gassose ed oleose in essi contenuti, filtrati mediante doppio step di filtrazione (con filtri a cartuccia da 50 e 10 μm e con filtro coalescente) e successivamente inviati al package di osmosi inversa seguito dal package di potabilizzazione e acqua demineralizzata. L'acqua così trattata è stoccata e riutilizzata internamente all'impianto andando a coprire i fabbisogni delle unità di processo, dei sistemi ausiliari, l'irrigazione e il rabbocco antincendio.

Le caratteristiche dell'acqua in entrata nell'unità di trattamento sono riportate nella Tabella 3-3.

TABELLA 3-3: PROPRIETÀ DELL'ACQUA IN ENTRATA ALL'IMPIANTO DI TRATTAMENTO	
Quantità in entrata	10 m ³ /d
Pressione	3 barg
Temperatura	55 °C

Le fasi di processo descritte e le aree dell'impianto relative alla fase di separazione del gas in entrata all'impianto sono schematizzate nelle figure successive (Figura 3-4 e Figura 3-5).

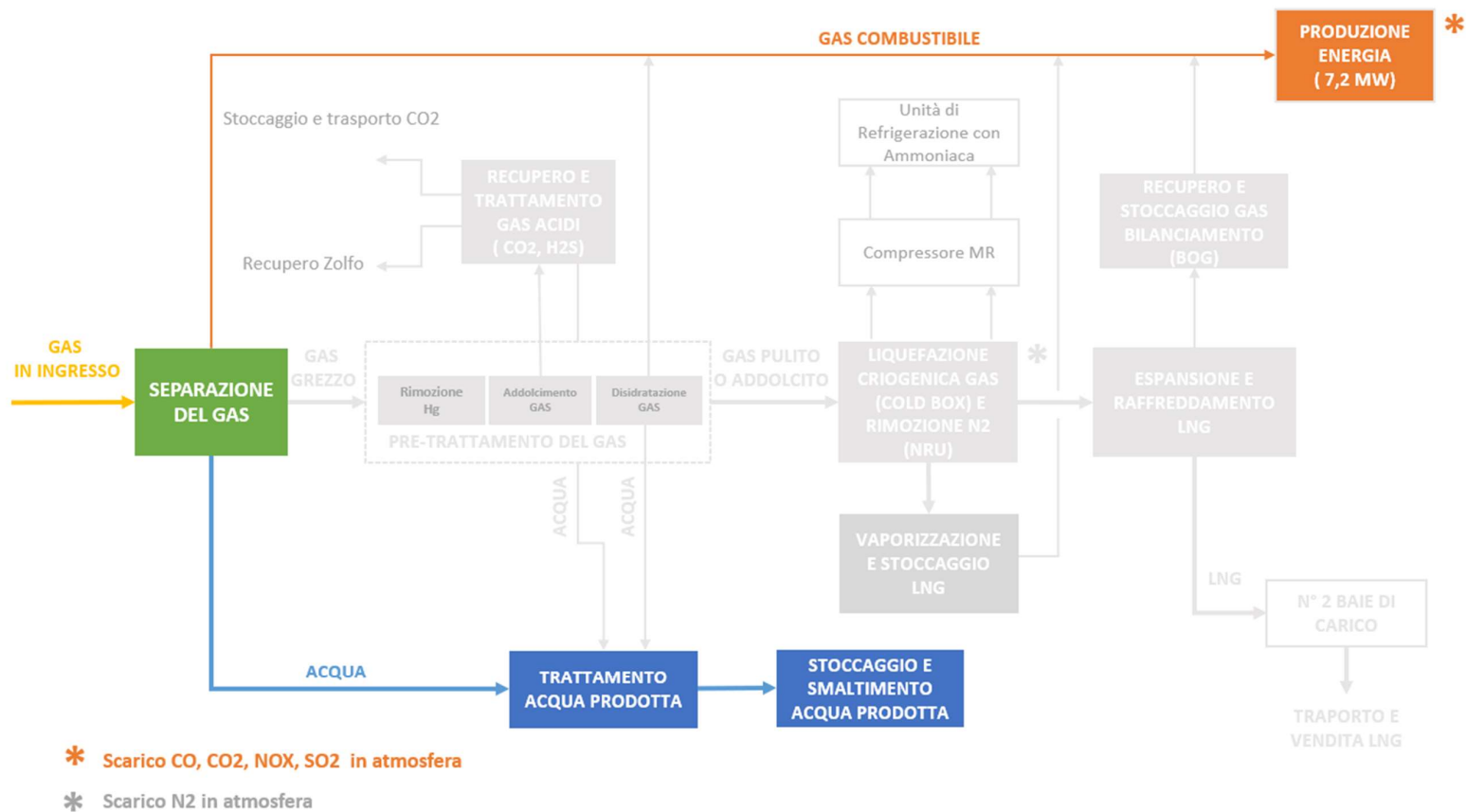


FIGURA 3-4: SCHEMA A BLOCCHI RAPPRESENTANTE LA FASE DI SEPARAZIONE DEL GAS (IN VERDE)

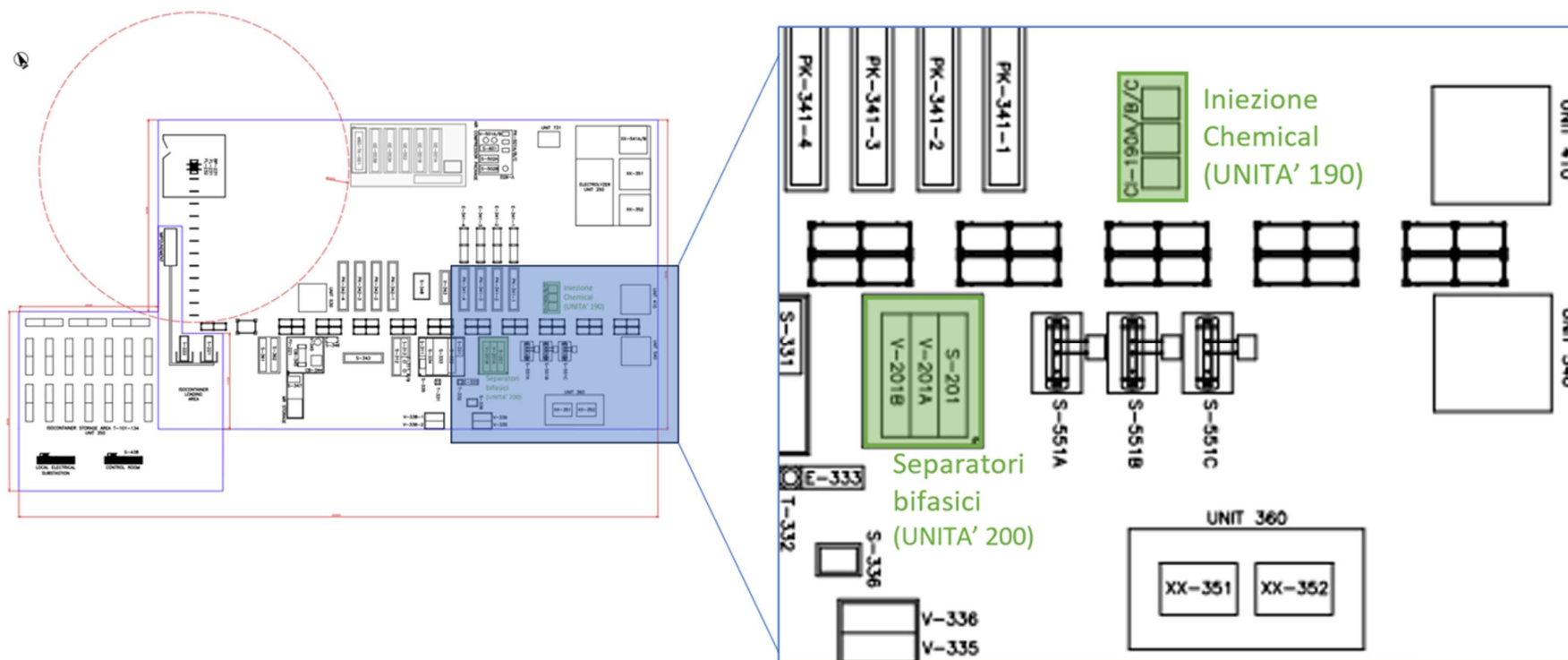


FIGURA 3-5: AREE IMPIANTISTICHE DESTINATE ALLA SEPARAZIONE (IN VERDE)

3.1.2 Fase di pre-trattamento

Il gas grezzo proveniente dal sistema di rimozione del Mercurio, contenente H_2S e CO_2 viene inviato alle successive sezioni di trattamento, ovvero *Addolcimento (Unità 330)* e *Disidratazione (Unità 310)*.

Il processo di addolcimento del gas prevede la rimozione ed il recupero come sottoprodotto, delle impurità in esso presenti come anidride carbonica (CO_2), e idrogeno solforato (H_2S) proteggendo al contempo la successiva unità di liquefazione criogenica e preservandone la funzionalità meccanica.

Il gas grezzo entra in uno scambiatore di calore (Gas/Gas Heat Exchanger) posto all'ingresso dell'Unità 330 in cui viene riscaldato recuperando il calore del gas addolcito in uscita dalla medesima unità, successivamente attraversa un separatore bifasico che ha lo scopo di rimuovere eventuali tracce di liquido ancora presenti nel gas.

La rimozione dei componenti acidi si realizza all'interno di una colonna di assorbimento (T-331 Amine Contactor/Absorber) all'interno della quale il gas grezzo entra in contatto controcorrente con un solvente composto da soluzioni liquide di ammine (composti organici contenenti azoto). I componenti acidi (CO_2 e H_2S) si trasferiscono dal gas grezzo al solvente in uscita dal fondo della colonna, mentre il gas addolcito, epurato dei componenti acidi, fuoriesce dalla testa della colonna.

La soluzione di ammina ricca di componenti acidi (Rich Amine) lascia la colonna di assorbimento e attraversa un separatore in cui la pressione della soluzione è ridotta al fine di consentire la vaporizzazione istantanea degli idrocarburi solubili e la rimozione degli idrocarburi condensati. Uscendo dal separatore l'ammina ricca è introdotta in uno scambiatore di calore (Rich/Lean Amine Heat Exchanger) in cui viene riscaldata ad opera dell'ammina povera proveniente dalla colonna di rigenerazione (Amine Regenerator) e successivamente raggiunge la sommità della colonna di rigenerazione in cui si realizza lo stripping del gas acido dal solvente. Il gas acido di stripping, è inviato all'Unità di recupero e trattamento Gas Acidi (Unità 360) mentre l'ammina rigenerata, definita ammina "magra" (Lean ammine) viene ricircolata allo scambiatore (Rich/Lean Amine Heat Exchanger) in cui preriscalda il solvente ricco. Una parte della soluzione viene filtrata al fine di ridurre al minimo la quantità di prodotti di degradazione potenzialmente corrosivi e la quantità di agenti antischiuma da utilizzare, migliorando complessivamente il controllo della colonna di assorbimento. L'ammina rigenerata è dunque utilizzata nuovamente nella colonna di Assorbimento.

Il gas addolcito in uscita dalla colonna di assorbimento cede calore al gas grezzo in entrata all'Unità 330 attraverso uno scambiatore (Gas/Gas Heat Exchanger) e viene inviato alla successiva sezione di Disidratazione (Unità 310).

I quantitativi previsti e le caratteristiche del gas in entrata all'Unità di recupero e trattamento Gas Acidi (Unità 360) sono riportati nella tabella a seguire.

TABELLA 3-4: QUANTITATIVI E CARATTERISTICHE GAS IN ENTRATA NELL'UNITÀ DI RECUPERO E TRATTAMENTO GAS ACIDI	
Stima delle quantità in entrata	2.662 Nm ³ /d 2.808 Sm ³ /d
Pressione	1,2 barg
Temperatura	43,12 °C
H₂S	24,98 %mol
CO₂	70,13 %mol

Nell'unità di Recupero e Trattamento dei Gas Acidi, attraverso le migliori tecnologie disponibili (BAT), si procederà alla cattura della H₂S contenuta nel gas attraverso l'utilizzo di trappole catalitiche costituite più serbatoi riempiti con materiale granulare a base di ossido metallico misto poroso su una base igroscopica stabile. Il riempimento catalitico è licenziato ed idoneo alla rimozione dello zolfo presente nella corrente gassosa. Il solido catalitico assorbente viene sostituito regolarmente e inviato presso fornitore qualificato per effettuarne la rigenerazione. Per rendere possibile le operazioni di sostituzione del solido catalitico e permettere al contempo il funzionamento dell'impianto in continuo, si utilizzano 2 letti catalitici, di cui uno operativo, l'altro in rigenerazione.

La corrente di gas a valle del suddetto trattamento raggiunge un contenuto finale inferiore a 100ppb (max), utile al successivo trattamento di recupero e purificazione della CO₂ mediante distillazione. La CO₂ purificata ottenuta viene stoccata e successivamente resa disponibile per il caricamento e trasporto (Ved. Par. 3.6.1). I quantitativi di H₂S e CO₂ recuperati dal gas trattato sono riportati nella tabella a seguire (Tabella 3-5).

TABELLA 3-5: QUANTITATIVI RECUPERATI DI CO ₂ E ZOLFO		
	Quantitativi orari	Quantitativi giornalieri
CO₂	151,1 Kg	3,67 ton
Zolfo equivalente	39,48 Kg	1,00 ton

Il gas proveniente dall'Unità di addolcimento è inviato all'Unità di disidratazione in cui si realizza la rimozione dell'acqua contenuta nel gas addolcito, su letto solido. Il gas è preventivamente raffreddato all'interno di uno scambiatore di calore che utilizza uno spurgo della corrente ricca di idrocarburi pesanti proveniente dall'Unità di Liquefazione criogenica del gas e rimozione Azoto (Unità 340).

Per ottenere la disidratazione del gas con continuità è necessario disporre di due letti adsorbenti (di cui uno operativo, uno in rigenerazione). L'adsorbimento dell'acqua si realizza facendo fluire il gas dall'alto al basso della colonna di adsorbimento (down flow). La rigenerazione del letto è effettuata interrompendo il ciclo di adsorbimento prima che il letto si saturi completamente d'acqua e utilizzando una parte del gas secco ottenuto, opportunamente riscaldato. Il gas di rigenerazione viene fatto fluire in senso opposto a quello d'adsorbimento (up flow) per garantire la rimozione completa dell'acqua adsorbita. Tale gas viene quindi raffreddato e successivamente inviato ad un separatore per la rimozione dell'acqua in esso contenuta.

L'acqua prodotta dall'unità di disidratazione è inviata all'impianto di trattamento dell'acqua (Unità 530) e, successivamente, stoccata per il riutilizzo all'interno dell'impianto.

Nella Tabella 3-6 sono riportate le caratteristiche delle apparecchiature relative alle fasi di processo descritte. Nella Figura 3-6 è rappresentata l'Unità di Addolcimento, mentre la Figura 3-7 riporta la Colonna di Rigenerazione (T-332) e la Colonna di Assorbimento (T-331).

TABELLA 3-6: CARATTERISTICHE DELLE APPARECCHIATURE DELLA FASE DI PRE-TRATTAMENTO			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
UNITÀ DI ADDOLCIMENTO			
330	S-331	AMINE INLET SKID (Includes)	12x2,3x2,6 20 Ton
	S-332	AMINE LEAN/RICH SKID (Includes)	12x2,3x2,6 20 Ton
	T-331	AMINE CONTACTOR/ABSORBER	17x0,95 21 Ton
	T-332	AMINE REGENERATOR	18x1,17 16 Ton
	E-333	AMINE REBOILER	5x1,8x2,4 19 Ton
	S-333	AMINE LEAN SKID	12x4,6x2,6 20 Ton
	S-334	AMINE REFLUX SKID	12x2,3x2,6 45 Ton
	S-335	FRESH AMINE/WATER MAKEUP	3x2x2 3,5 Ton
	V-335	DEMINERALIZED WATER SOLUTION TANK	6x2,43x2,6 35 Ton
	V-336	FRESH AMINE TANK	6x2,43x2,6 35 Ton
	V-338	EXHAUST AMINE STORAGE TANK	6x2,43x2,6 35 Ton
UNITÀ DI RECUPERO E TRATTAMENTO GAS ACIDI			
360	XX-351	RIMOZIONE H ₂ S	10x10x2,6 10 Ton
	XX-352	CO ₂ CAPTURE & RECOVERY	10x10x2,6 10 Ton
UNITÀ DI DISIDRATAZIONE			
310	S-311	DEHY INLET-OUTLET SKID	6x2,4x2,6 20 ton
	S-312	DEHY REGENERATION SKID	11,5x2,4x2,6 20 Ton
	T-311A	ADSORBER BED	2x0,84 20 Ton
	T-311B	ADSORBER BED	2x0,84 20 Ton



FIGURA 3-6: UNITÀ DI ADDOLCIMENTO (SKID DI INGRESSO S-331, SKID AMMINA LEAN/RICH S-332, SKID AMMINA LEAN S-333, SKID DI RIFLUSSO AMMINA S-334, SKID REINTEGRO ACQUA E AMMINA S-335)

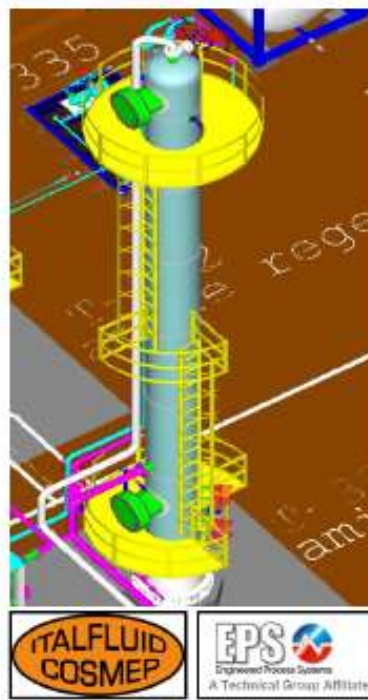
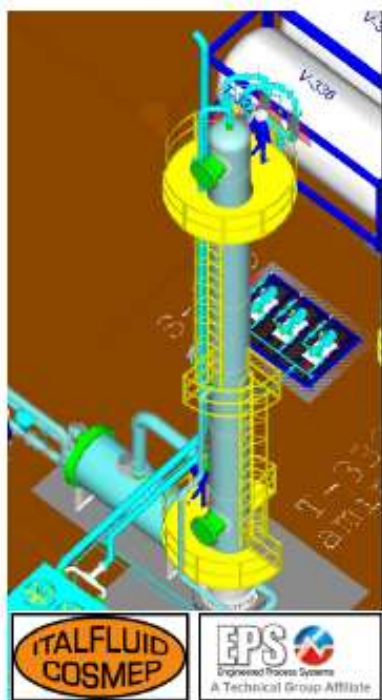


FIGURA 3-7: COLONNA DI RIGENERAZIONE (T-332), COLONNA DI ASSORBIMENTO (T-331)

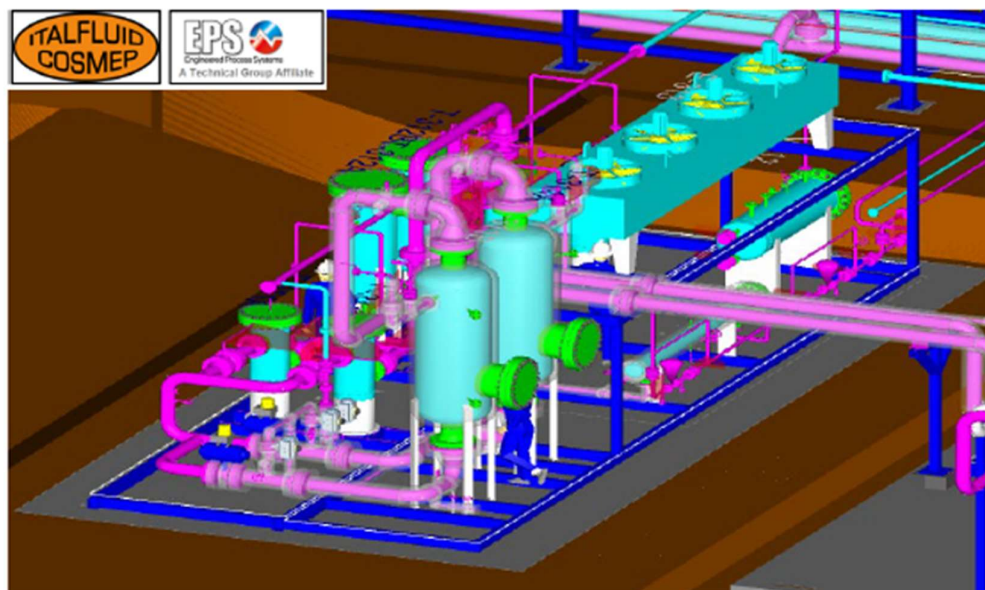


FIGURA 3-8: UNITÀ DI DISIDRATAZIONE

Le fasi di processo descritte e le aree dell'impianto relative alla fase di pretrattamento sono schematizzate nelle figure successive (Figura 3-9 e Figura 3-10).

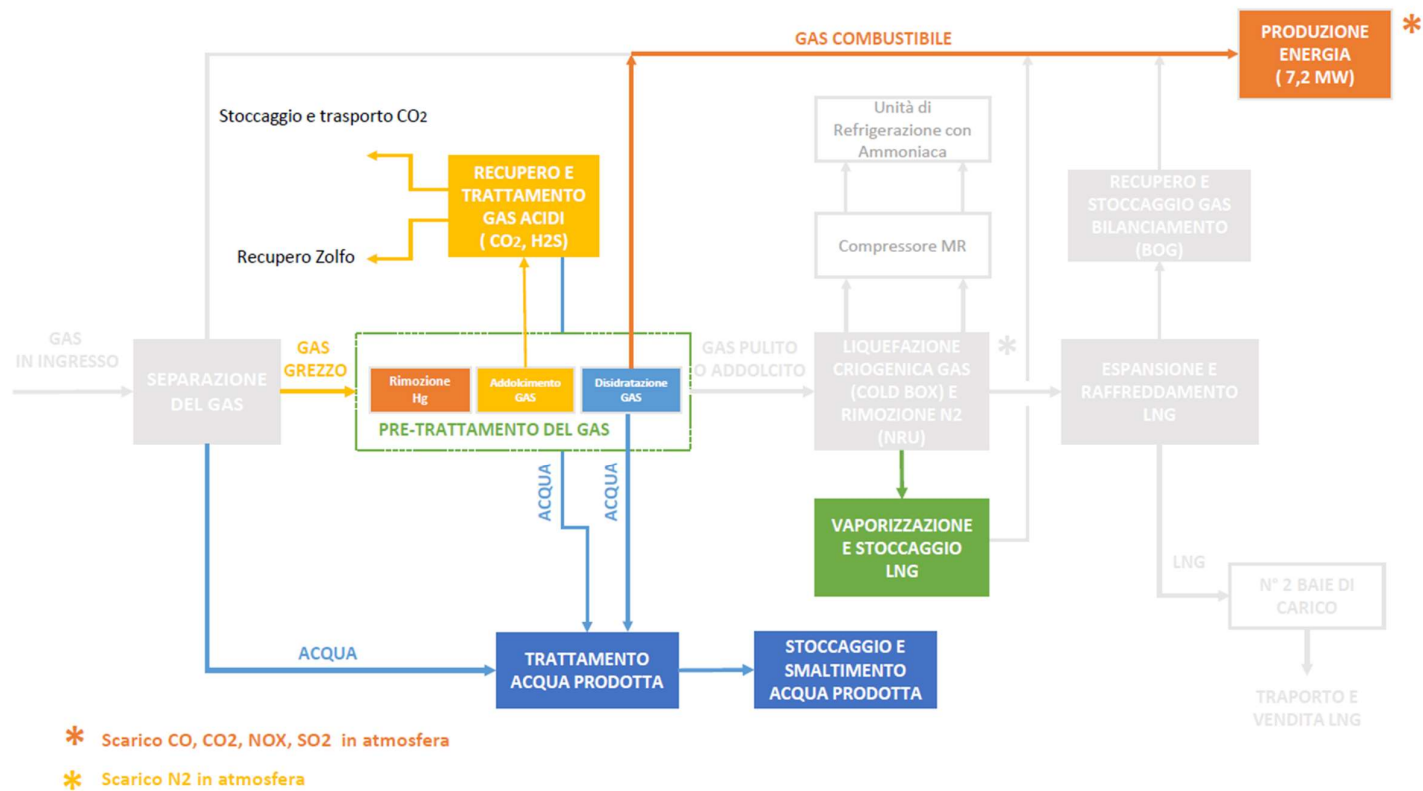


FIGURA 3-9: SCHEMA A BLOCCHI RAPPRESENTANTE LA FASE DI PRE-TRATTAMENTO (IN GIALLO)

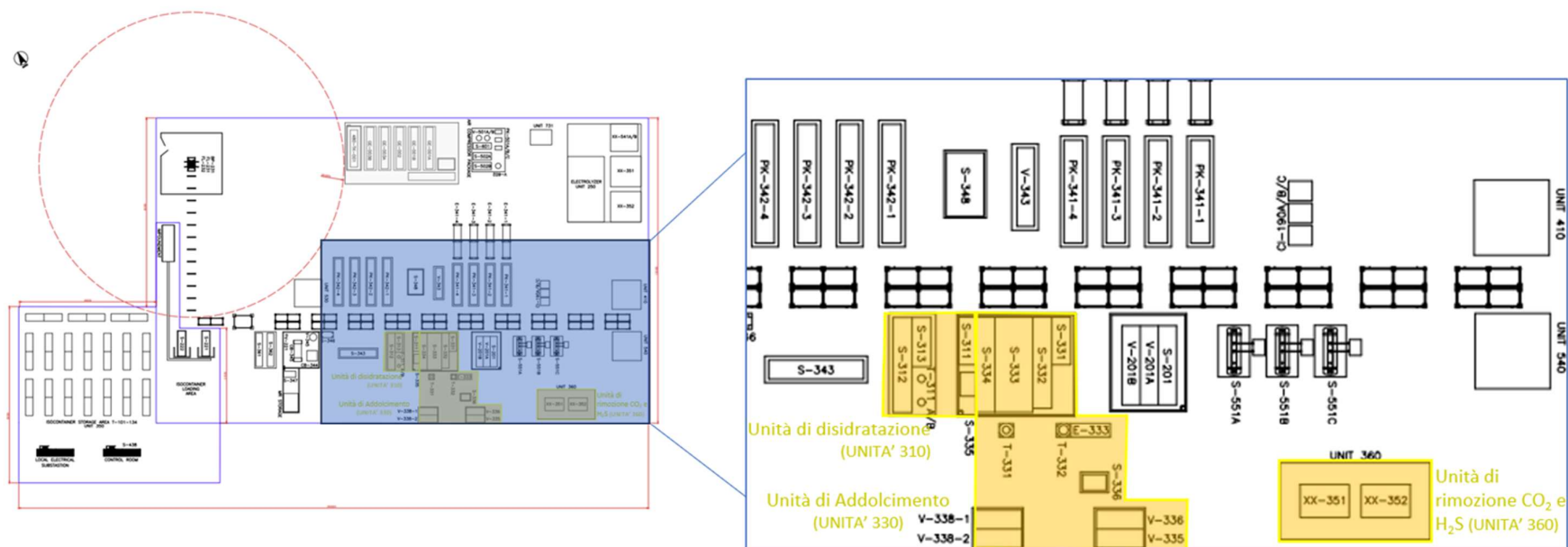


FIGURA 3-10: AREE IMPIANTISTICHE DESTINATE AL PRE-TRATTAMENTO (IN GIALLO)

3.1.3 Fase di Liquefazione del gas

Nella sezione di liquefazione criogenica del gas e di rimozione dell'azoto, il gas pulito entra nella *Cold Box* (CB-344) per essere raffreddato in un ciclo di refrigerazione a ciclo chiuso per mezzo di un fluido costituito da una miscela di idrocarburi e materiali inerti (*Mixed Refrigerant*). Il Mixed Refrigerant, precedentemente compresso, evapora nella *Cold Box* a pressione atmosferica e ad una temperatura di circa -160 °C, fornendo così le frigorificazioni necessarie alla liquefazione del gas.

Si utilizza un ciclo di refrigerazione con ammoniaca a supporto del Mixed Refrigerant, con lo scopo di raffreddare al di sotto della temperatura ambiente il Mixed Refrigerant in uscita dallo scambiatore di calore ad aria posto a valle della compressione. Per ottenere l'indice di Wobbe e le specifiche relative al valore di riscaldamento più elevato dell'LNG, è previsto lo spurgo di una corrente ricca di idrocarburi pesanti. Questa corrente viene successivamente rivaporizzata all'interno di uno scambiatore, utilizzando il gas addolcito e di seguito utilizzata per la produzione di energia elettrica. L'LNG, epurato degli idrocarburi pesanti, subisce un ulteriore raffreddamento nella *Cold Box* per poi entrare all'interno della sezione di distillazione criogenica NRU (*Nitrogen Rejection Unit*) che ha lo scopo di rimuovere l'azoto contenuto nel gas fino al valore residuo di 1% molare.

L'azoto proveniente dalla testa della colonna di distillazione criogenica, dopo un'espansione finalizzata ad abbassarne ulteriormente la temperatura (-188,5°C), è nuovamente inviato alla *Cold Box*, quindi immesso in atmosfera nel rispetto dei limiti di legge.

Nella Tabella 3-7 e nelle Figure 3-11,3-12,3-13, sono riportate rispettivamente le caratteristiche delle apparecchiature relative alle fasi di processo descritte nel presente paragrafo e le principali apparecchiature di processo.

TABELLA 3-7: CARATTERISTICHE DELLE APPARECCHIATURE DELLA FASE DI REFRIGERAZIONE E LIQUEFAZIONE			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
UNITÀ DI LIQUEFAZIONE CRIOGENICA DEL GAS E RIMOZIONE AZOTO			
340	PK-341-1	AMMONIA COMPRESSOR PACKAGE	13x2,4x2,9 18 Ton
	PK-341-2	AMMONIA COMPRESSOR PACKAGE	13x2,4x2,9 18 Ton
	PK-341-3	AMMONIA COMPRESSOR PACKAGE	13x2,4x2,9 18 Ton
	PK-341-4	AMMONIA COMPRESSOR PACKAGE	13x2,4x2,9 18 Ton
	S-341	AMMONIA CONDENSER WITH LIQUID RECEIVER	5x0,8 15 Ton
	PK-342-1	MR COMPRESSOR PACKAGE	15x2,4x2,6 27 Ton
	PK-342-2	MR COMPRESSOR PACKAGE	15x2,4x2,6 27 Ton
	PK-342-3	MR COMPRESSOR PACKAGE	15x2,4x2,6 27 Ton
	PK-342-4	MR COMPRESSOR PACKAGE	15x2,4x2,6 27 Ton
	S-343	MR PRECOOLING	12x2,4x2,65 37 Ton
	CB-344	COLD BOX	3,4x3,4x11,6 33 Ton
	CB-345	NITROGEN REJECTION UNIT	7x2,4x11 25 Ton
	S-346	NGL AND CONDENSATE VAPORIZER SKID	4x2x2,8 10 Ton
	S-347	MIX REFRIGERANT MAKEUP	4x2,4x2,8 13 Ton
	V-345	MR SUCTION KO DRUM	3,6x2,4 18 Ton
	S-348	OIL REMOVAL SYSTEM	8x4,8x6,6 32 Ton

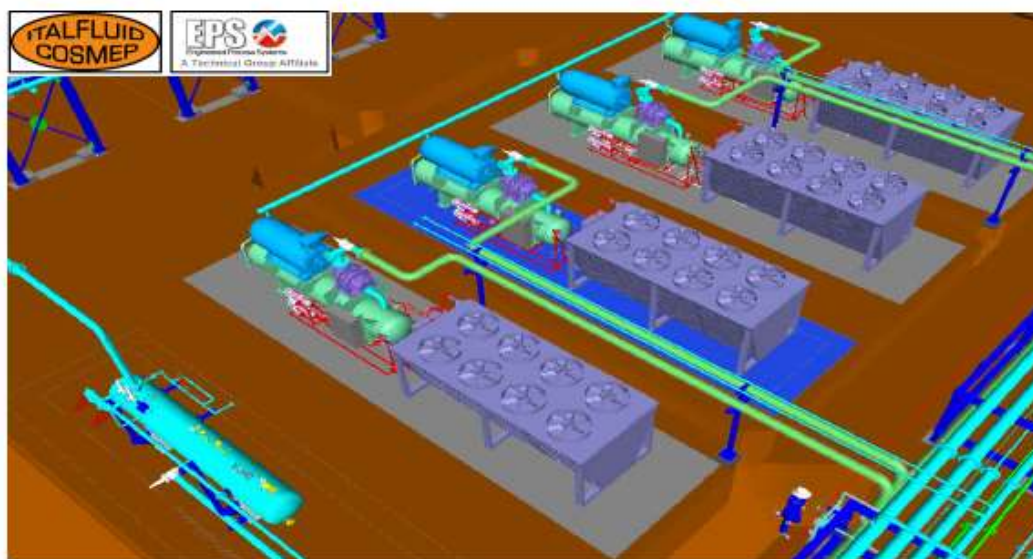


FIGURA 3-11: COMPRESSORE E CONDENSATORE (UNITÀ 340 – PK-341 1,2,3,4, s-341)

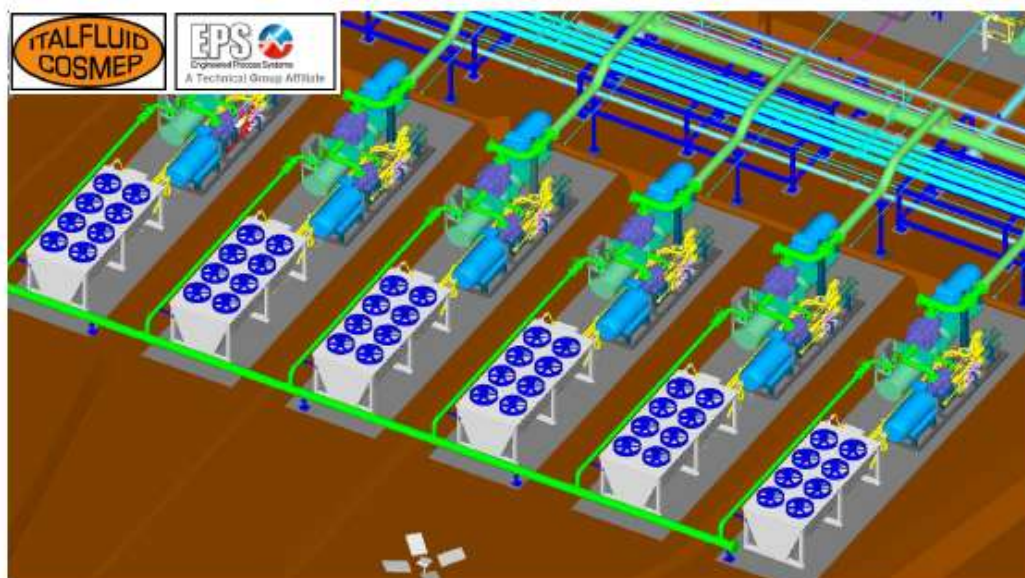


FIGURA 3-12: COMPRESSORI E PRE-RAFFREDDAMENTO (UNITÀ 340 – PK-342 1,2,3,4, S-343)



FIGURA 3-13: COLD BOX, NGL AND CONDENSATE VAPORIZER SKID, MIX REFRIGERANT MAKEUP, MR SUCTION KO DRUM E SISTEMA DI RIMOZIONE OLIO (UNITÀ 340 – CB-344, S-346, S-347, V-345, S-348)

Le fasi di processo descritte e le aree dell'impianto relative alla fase di liquefazione del gas sono schematizzate nelle figure a seguire (Figura 3-4 e Figura 3-5).

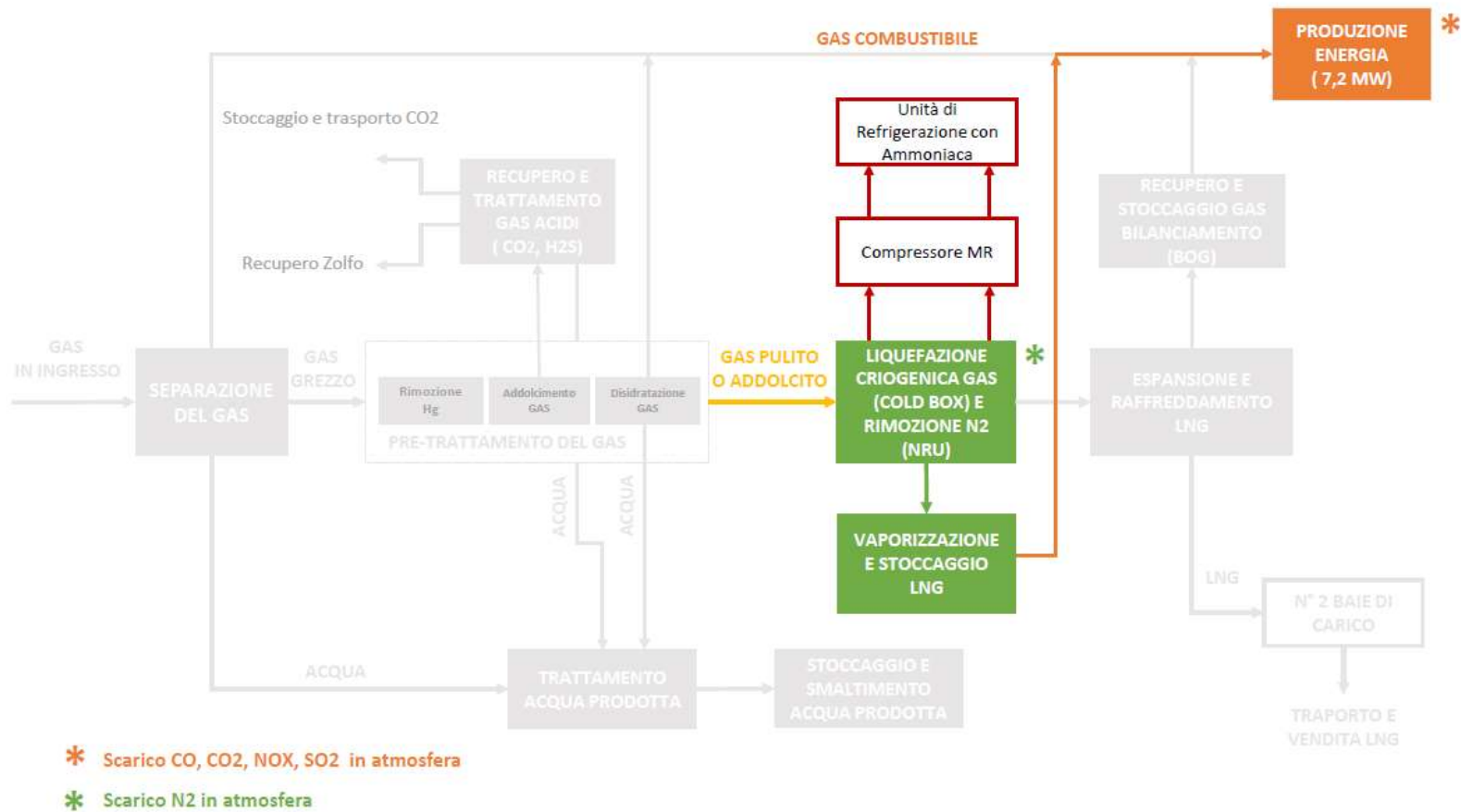


FIGURA 3-14: SCHEMA A BLOCCHI DELLA FASE DI LIQUEFAZIONE

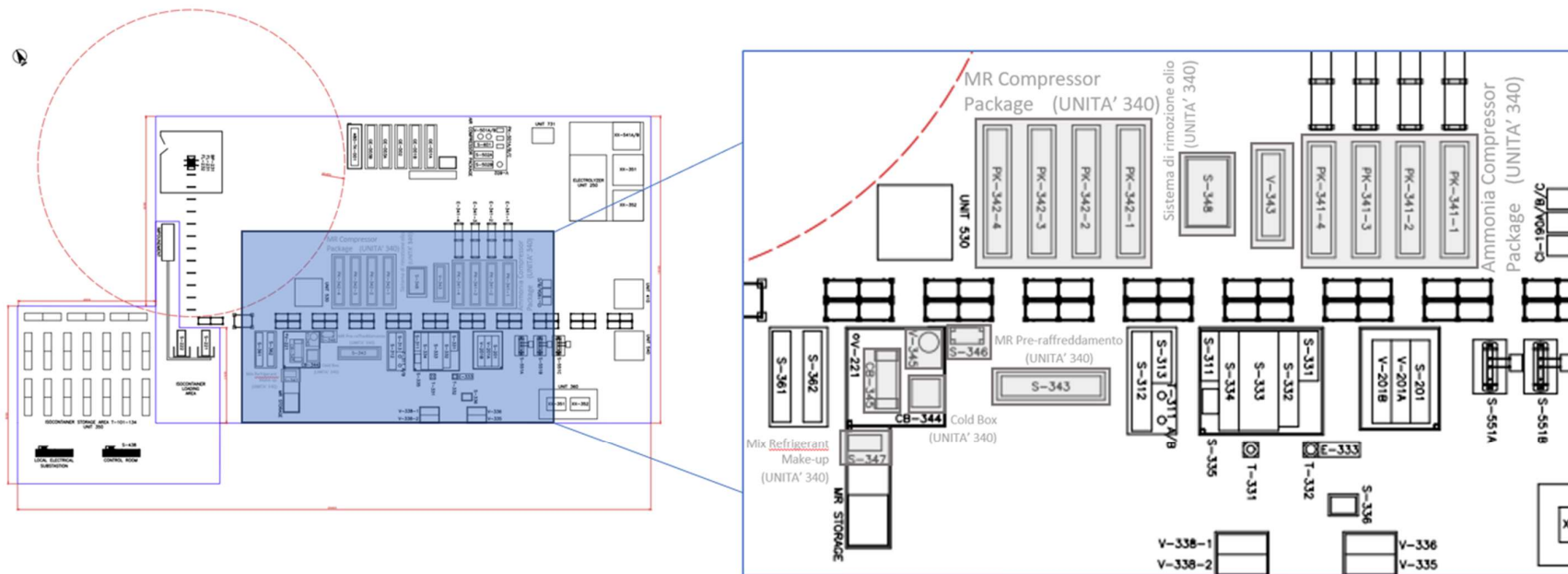


FIGURA 3-15: AREE IMPIANTISTICHE DESTINATE ALLA REFRIGERAZIONE E LIQUEFAZIONE (IN GRIGIO)

3.1.4 Fase di stoccaggio e trasporto del gas

L'LNG in uscita dall'unità di liquefazione subisce un'espansione Joule-Thompson attraverso una valvola apposita raffreddandosi ulteriormente. Dopo tale laminazione l'LNG è indirizzato ad un separatore (V221) e i gas di respirazione dello stesso vengono utilizzati come gas combustibile per la produzione di energia elettrica nell'impianto dopo la ricompressione all'interno dell'Unità di recupero e stoccaggio dei gas di Bilanciamento (Unità 380).

Di seguito si riporta la composizione garantita dell'LNG disponibile alle baie di carico.

	Unità	Specifiche garantite LNG
Metano	(% mole)	> 93%
Azoto	(% mole)	< 1.0%
CO ₂	(ppmv)	< 50
Acqua	(ppmv)	< 0.1
S contenuto totale	(mg/Nm ³)	< 30
S da H ₂ S & COS	(mg/Nm ³)	< 5
S da RSH	(mg/Nm ³)	< 6
Hg	(nano-g/Sm ³ or ppb/Sm ³)	< 10
O ₂	(% mole)	< 0.002
HHV	(MJ/Nm ³)	> 38
Indice di Wobbe	(MJ/Nm ³)	> 50
Peso molecolare	(kg/kmole)	16 - 19

Il separatore è realizzato con opportuni materiali isolanti in modo da mantenere al suo interno l'LNG a circa -160°C.

Una volta che il gas naturale è stato estratto e liquefatto attraverso uno speciale processo di raffreddamento, si verificherà una riduzione di volume di circa 600 volte inferiore rispetto allo stato gassoso. Questo processo garantirà un semplice trasporto del prodotto sia via terra che via mare, rendendolo immediatamente disponibile come carburante per il trasporto di veicoli e imbarcazioni.

Il sistema di carico del gas liquefatto, composto da 2 baie di carico (Unità 220), sarà gestito in modo da consentire il rifornimento degli ISO-Container del volume di 20 m³. È previsto il caricamento di 14 ISO - container al giorno che verranno movimentati attraverso 7 viaggi al giorno con motrice/bilico ribassato.



FIGURA 3-16: CARICAMENTO ISO- CONTAINER SU MOTRICE/BILICO RIBASSATO

Le fasi di processo descritte e le aree dell'impianto interessate dalla fase di stoccaggio del gas liquefatto sono schematizzate nelle figure a seguire (Figura 3-17 - Figura 3-18).

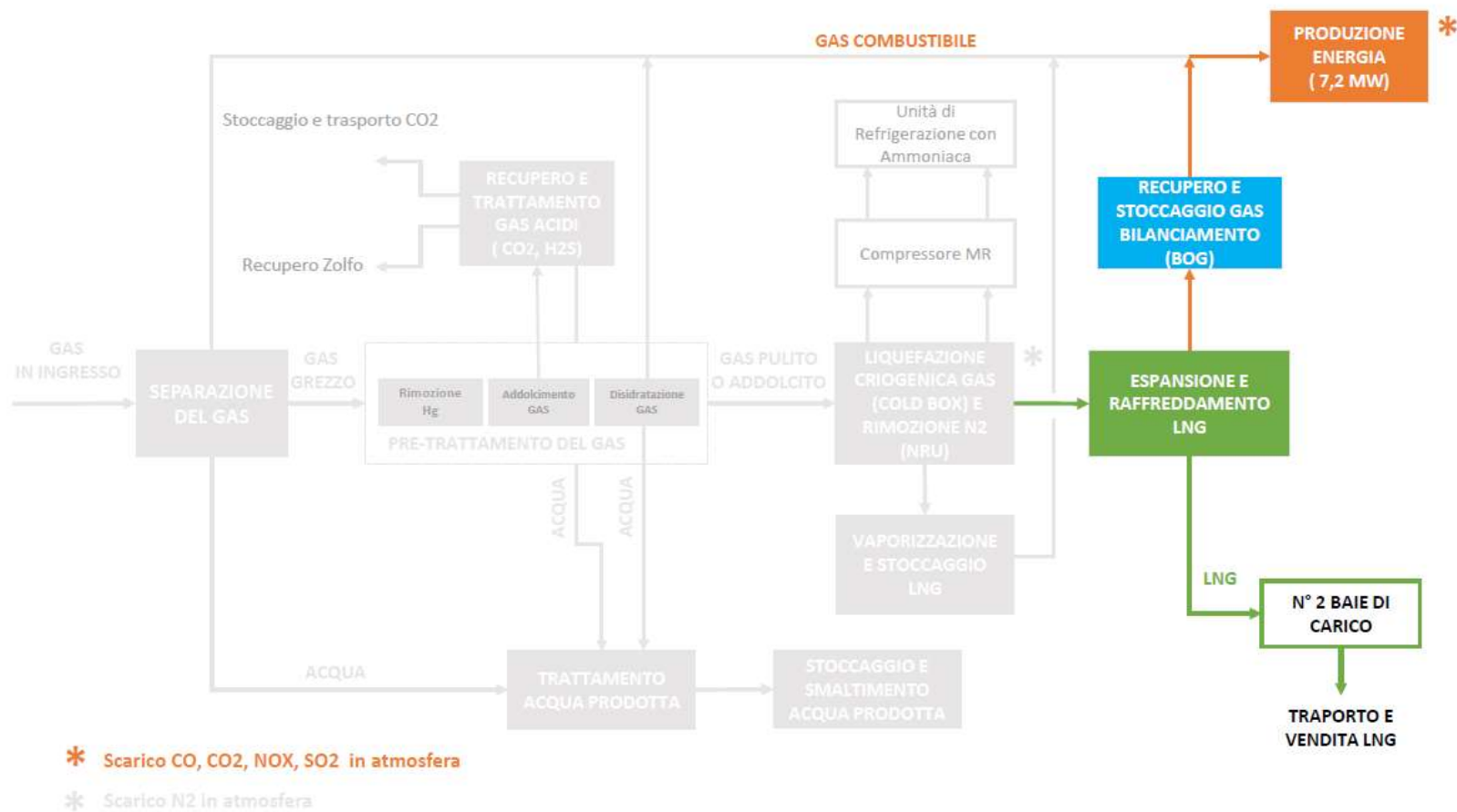


FIGURA 3-17: SCHEMA A BLOCCHI DELLA FASE DI STOCCAGGIO E TRASPORTO

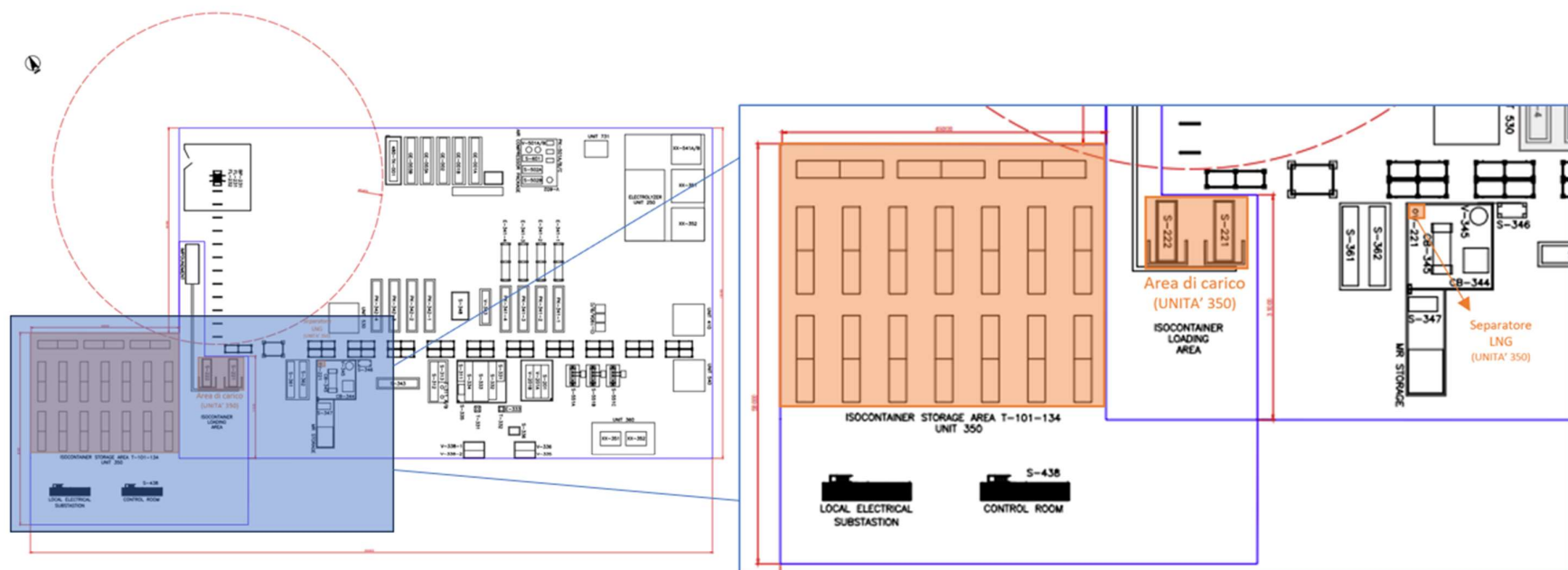


FIGURA 3-18: AREE IMPIANTISTICHE DESTINATE ALLO STOCCAGGIO DELL'LNG (IN ARANCIONE)

Gli ISO-Container possono essere utilizzati come deposito di carburante mobile e la quantità di prodotto trasferito è flessibile in quanto dipende dal numero di serbatoi. Tra le cisterne mobili, notiamo la possibilità di utilizzare gli ISO-Container, che sono serbatoi criogenici portatili di dimensioni standard, uguali a quelli di un contenitore ISO (1 unità equivalente di venti piedi (TEU)) o di un contenitore doppio (2 unità equivalente di venti piedi TEU). Possono essere caricati su una nave con gru dedicate o possono essere caricati su un treno stradale in modalità Ro Ro (Roll-on/ Roll-off). Come tutti i container ISO, sono intermodali, quindi possono viaggiare su gomma, treno o nave.



TVAC® & PVAC Intermodal Container

TVAC® & PVAC 20 ft.

- The TVAC Intermodal Containers come in a variety of working pressures from 145 psig to 348 psig for EN coded vessels and from 100 psig to 230 psig for ASME coded vessels.
- The TVAC comes with a pressure building vaporizer for pressure transfer.
- The PVAC Intermodal Containers utilize similar features as the TVAC, but is designed for pump use with a self-contained pump transfer system.

FIGURA 3-19: SERBATOI CRIOGENICI PORTATILI DI DIMENSIONI STANDARD (ISO-CONTAINER)

Nella tabella a seguire (Tabella 3-8) l'elenco e le caratteristiche delle apparecchiature coinvolte in questa fase.

TABELLA 3-8: CARATTERISTICHE DELLE APPARECCHIATURE DELLA FASE DI STOCCAGGIO LNG			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
UNITÀ DI REFRIGERAZIONE E LIQUEFAZIONE			
220	V-221	LNG SEPARATOR	2,5x0,8 10 Ton
	S-221	LOADING STATION #1 (INCLUDES)	8x2,2x2,4 15 Ton
	S-222	LOADING STATION #2 (INCLUDES)	8x2,2x2,4 15 Ton
ISOCONTAINER			
350	T-101-...-134	ISOCONTAINER	6x2,4x2,6 4 Ton (ciascuno)

3.1.5 Altre unità presenti nell'area

Nella Figura 3-20 è mostrata l'Unità 380 di recupero e stoccaggio dei gas di bilanciamento (BOG) che riceve in entrata i gas di respirazione provenienti dal separatore V-211. Tale corrente gassosa è sottoposta a ricomprensione e successivamente inviata all'Unità di Generazione dell'Energia (Unità 480).

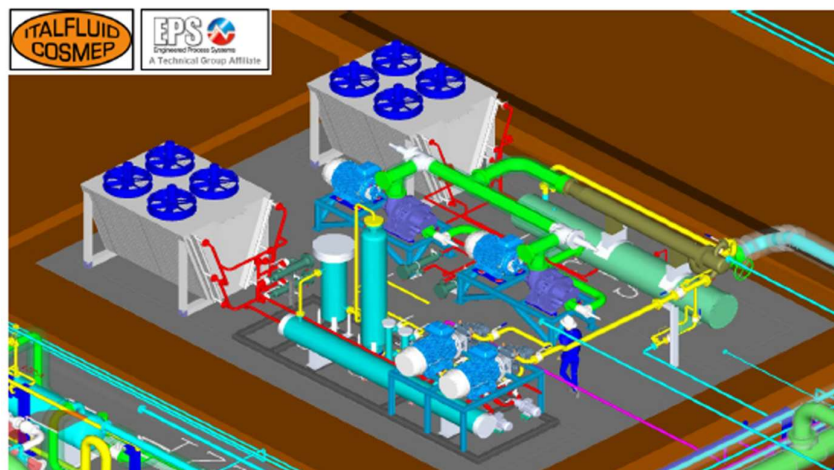


FIGURA 3-20: UNITÀ 380 (S-361 – COMPRESSORE FLASH GAS, S-362 COMPRESSORE GAS DI RICIRCOLO BOG)

Nella figura 3-21 è mostrato il package dell'aria compressa (Unità 500) e il package di generazione Azoto (Unità 650) che provvedono rispettivamente al fabbisogno dell'aria strumenti e al fabbisogno dell'Azoto necessari all'impianto.

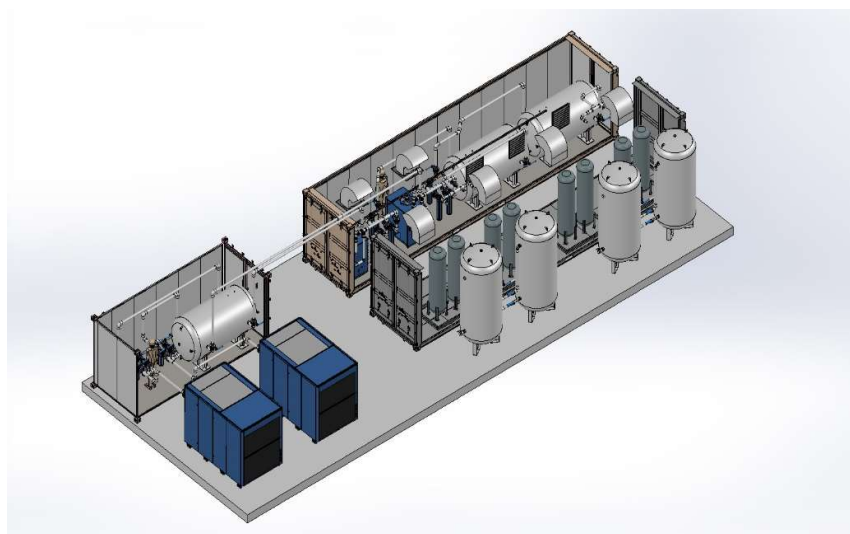


FIGURA 3-21: UNITÀ ARIA COMPRESSA (UNITÀ 500 – PK-501 A/B/C, V-501, S-502) E UNITÀ DI GENERAZIONE AZOTO (S-601 A, S-601 B, V-602)

Nella figura 3-22 è riportato uno dei tre serbatoi relativi al sistema di drenaggio delle unità di processo (Unità 580). La filosofia operativa è di prevedere un vessel di raccolta drenaggi per ciascuno dei tre servizi:

- Drenaggi amminici provenienti dall'Unità di Addolcimento
- Drenaggi Idrocarburi e Oleosi provenienti da tutte le unità di processo
- Drenaggi di condense acquose contaminate che non possono essere inviate all'Unità di trattamento acqua e reindirizzate all'impianto per uso interno.

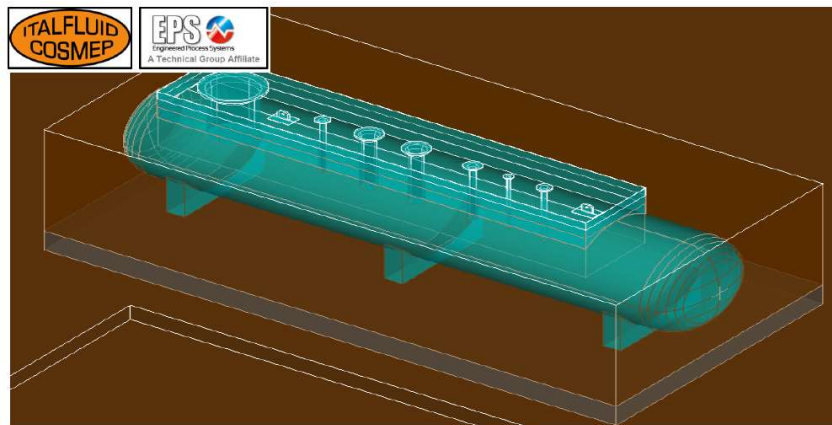


FIGURA 3-22: CLOSE DRAIN (UNITÀ 550 – S-551)

Nella Figura 3-23 sono mostrati i filtri a cartuccia da 50 e 10 μm e il Package di trattamento dell'acqua oleosa, facenti parte dell'Unità di trattamento dell'acqua (Unità 530).

Come precedentemente descritto, i condensati estratti dalle diverse unità di processo (ad esempio separazione, disidratazione ecc) sono inviati all'Unità 530, all'interno della quale sono sottoposti a successivi step di purificazione (doppio step di filtrazione con filtri a cartuccia da 50 e 10 μm , successiva filtrazione con filtro coalescente) per poi essere inviati ai package di osmosi inversa, purificazione e acqua demineralizzata. L'acqua così trattata è stoccata e riutilizzata internamente all'impianto andando a coprire i fabbisogni delle unità di processo, dei sistemi ausiliari, l'irrigazione e il rimbocco sistema antincendio.

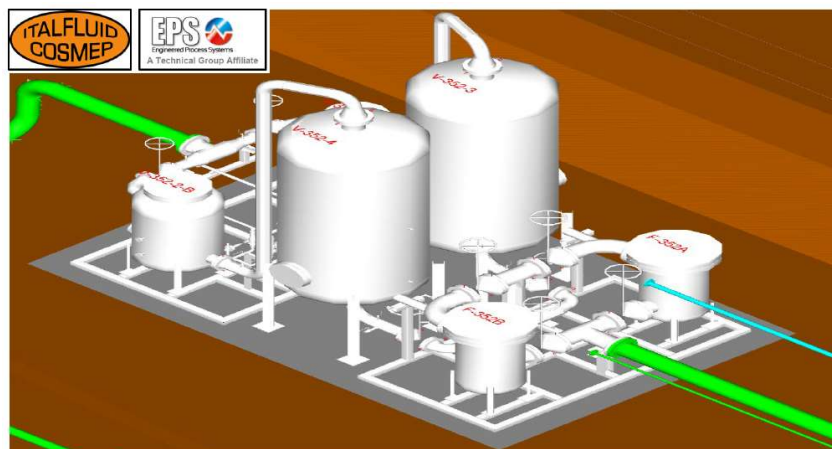


FIGURA 3-23: FILTRI A CARTUCCIA E PACKAGE TRATTAMENTO ACQUA OLEOSA (UNITA' 530)

Il package del sistema antincendio mostrato nella Figura 3-24 è principalmente costituito da due serbatoi di accumulo acqua antincendio (TK-731 A/B) e skid delle pompe di rilancio (XX-731) ed è stato progettato secondo le normative tecniche di riferimento per assicurare adeguato controllo e protezione dell'impianto in caso di incendio.

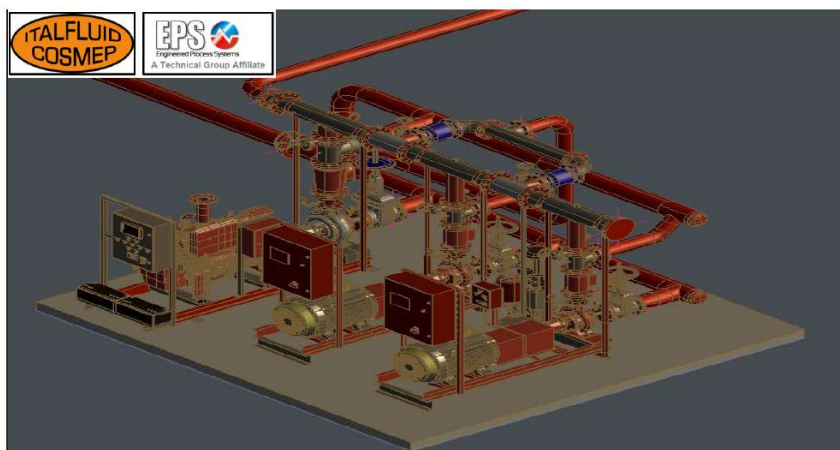


FIGURA 3-24: FIREFIGHTING (UNIT 730)

All'interno dell'impianto è utilizzato olio diatermico (Hot Oil) come mezzo riscaldante nelle diverse unità (Unità 330, 310, 340, 480) che costituiscono il processo. La portata complessiva è di circa 80 m³/h. Nella figura 3-25 è mostrata l'Unità 410 costituita dal package dell'Hot Oil.

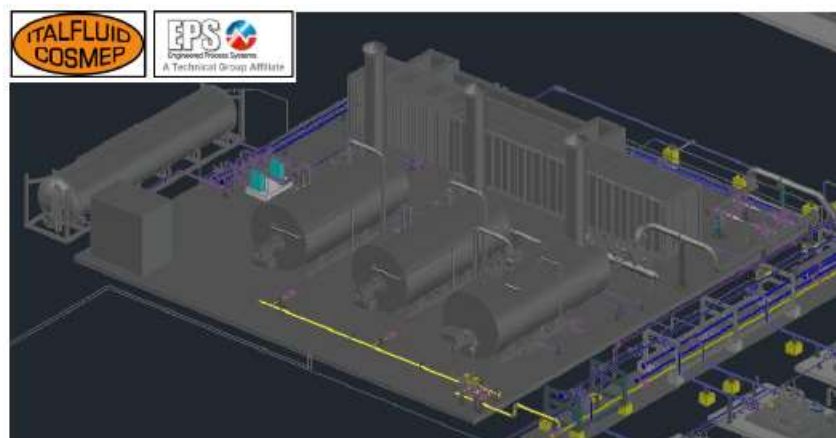


FIGURA 3-25: HOT OIL (UNITÀ 410)

All'interno dell'impianto è prevista la presenza di un Elettrolizzatore da 1 MW (Unità 250). L'Ossigeno prodotto è utilizzato nell'Ossidatore a corredo della Torcia calda nell'Unità 230, al fine di realizzare una combustione controllata volta a minimizzare i componenti inquinanti presenti nei gas di coda. L'idrogeno prodotto è ricircolato all'unità di Generazione di Energia (Unità 480) per migliorare le prestazioni della turbina elettrica o essere destinato a vendita/ fornitura come commodities presso eventuale utilizzatore.

3.2 Sistema di Torcia

Il sistema di torcia (Unità 230) è costituito da una torcia fredda (FL-232) ed una torcia calda (FL-231). La torcia calda recepisce in continuo i gas di coda dell'impianto provenienti dalle diverse unità di processo descritte in precedenza (ad esempio flash gas dall'unità di addolcimento, vent provenienti dal trattamento dell'acqua, gas provenienti dalla colonna di distillazione criogenica della CO₂). Tale sistema è corredato a monte di un Ossidatore alimentato con O₂ proveniente dall'elettrolizzatore (Unità 250), per realizzare una combustione in eccesso di Ossigeno finalizzata al controllo ed eliminazione degli inquinanti presenti nel gas di coda.

La torcia fredda recepisce invece eventuali scarichi di emergenza e/o occasionali, quindi intermittenti, come ad esempio quelli provenienti dalle valvole di Rilascio in Pressione (Pressure safety valve - PSV) e dalle valvole di depressurizzazione di emergenza (blow-down valve- BDV). Il sistema torcia fredda di conseguenza entra in funzione solamente in caso di emergenza (General Power Failure o Impianto Bloccato o altri eventuali scenari di emergenza) in cui il volume di gas intrappolato nelle unità di processo, deve poter essere scaricato in atmosfera in concomitanza con l'intervento automatico del sistema ESD (Emergency Shut Down), nel rispetto delle normative internazionali API RP 520 e 521.

Nella Tabella 3-9 le caratteristiche delle apparecchiature relative all'Unità 230, nella Figura 3-26 un esempio tipico di Torcia.

TABELLA 3-9: SISTEMA TORCIA			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
600	FL-231	HOT FLARE WITH OXYDIZER	5X5X18 10 Ton
	FL-232	VERTICAL EMERGENCY FLARE	5X5X18 10 Ton

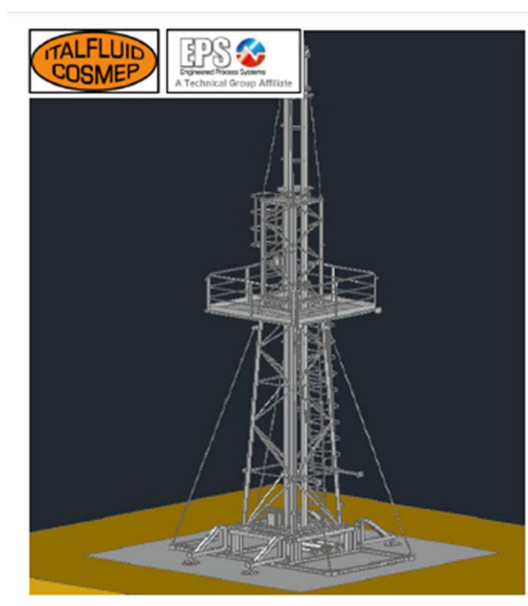


FIGURA 3-26: SISTEMA DI TORCIA

3.3 Unità di generazione dell'energia

Il Gas combustibile proveniente dalle diverse sezioni dell'impianto (ad esempio la corrente idro-carburica pesante spurgata nell'Unità 340 e successivamente vaporizzata, corrente proveniente dall'Unità 380 di recupero e stoccaggio del gas di bilanciamento ed eventuali altre correnti di reintegro interne alle unità di processo) è inviato all'impianto a Ciclo Combinato per la produzione di energia elettrica.

L'impianto di generazione energia è costituito da:

- N°2 Generatori Turbo-gas (GE-001 A e GE-001 B – Potenza nominale 4,8x2 MWe) di cui uno in running, l'altro in stand-by, equipaggiate con sistemi di recupero del calore dai gas di scarico (HRSG – Heat Recovery Steam Generator) per la produzione di vapore (HRSG-001 A e HRSG -001 B);
- Package di Turbine a vapore (XX-002 costituito da due turbine a vapore ST-001A e ST-001B - Potenza nominale 2,4x2 MWe) di cui una in running, l'altra in stand-by, equipaggiato con sistema di Boiler Feed Water in comune tra le due turbine.
- N°2 Generatori diesel d'emergenza (EDG-Emergency diesel Generator) (GE-003 A e GE-003 B)
- Serbatoi diesel (TK-001).

L'acqua utilizzata per la produzione di vapore è in ciclo chiuso. Le aree dell'impianto interessate dalla produzione di energia sono schematizzate nella figura a seguire.

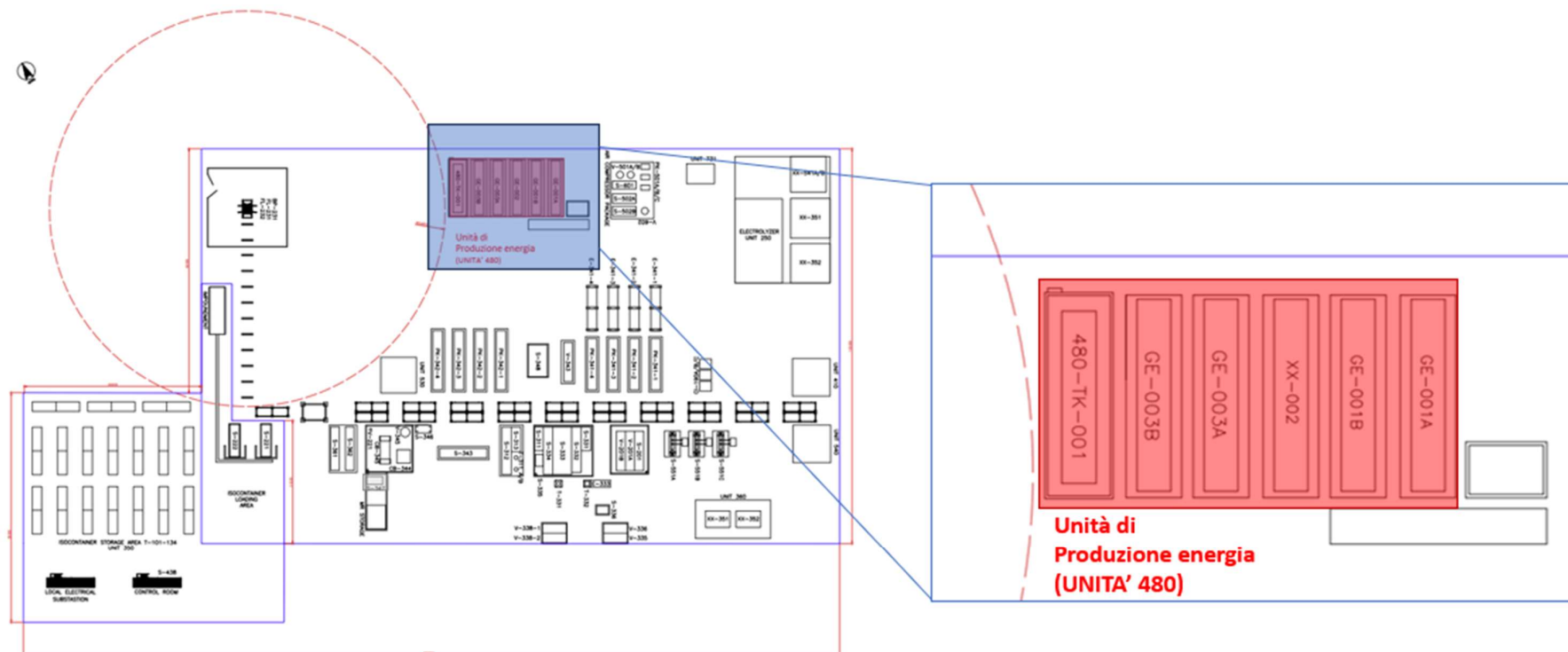


FIGURA 3-27: AREE IMPIANTISTICHE DESTINATE ALLA PRODUZIONE DI ENERGIA (IN Rosso)

Nella Tabella 3-10, l'elenco e le caratteristiche delle apparecchiature relative al sistema di produzione dell'energia.

TABELLA 3-10: CARATTERISTICHE DELLE APPARECCHIATURE DELLA FASE DI PRODUZIONE ENERGIA			
UNITA'	ITEM	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
UNITÀ DI PRODUZIONE ENERGIA			
480	GE-001 A	TURBO GAS GENERATOR with HRSG	17x12x8 20 Ton
	GE-001 B	TURBO GAS GENERATOR with HRSG	17x12x8 20 Ton
	XX-002 (ST-001A + ST-001B)	STEAM TURBINES PACKAGE with BFW System	17x12x8 20 Ton
	GE-003 A	EDG	6x2,4x2,6 5 Ton
	GE-003 B	EDG	6x2,4x2,6 5 Ton
	TK-001	DIESEL TANK	15X5X2 5 Ton

Nelle figure a seguire alcuni asset principali dell'Unità di produzione dell'Energia.



FIGURA 3-28: GENERATORE TURBO-GAS (UNITÀ 480 – GE-001)

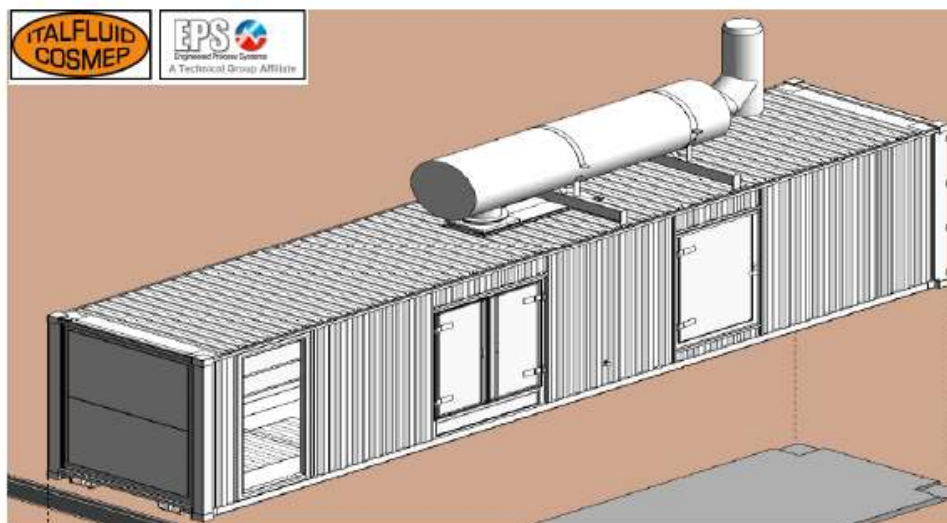


FIGURA 3-29: GENERAZIONE DI VAPORE E EDG (UNITÀ 480 – GE-002 E GE-003)

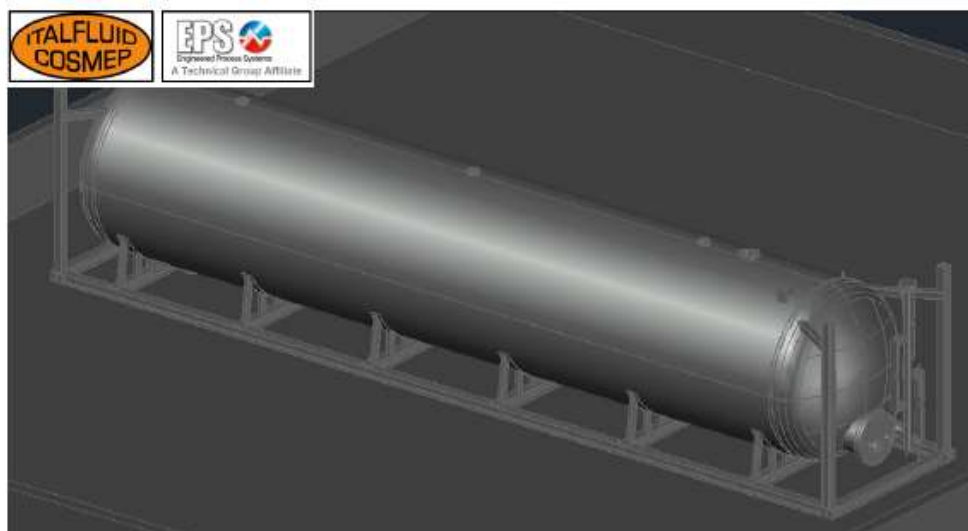


FIGURA 3-30: SERBATOIO DIESEL (UNITÀ 480 – TK001)

3.4 Cabinati

Nell'area impianto saranno presente anche una serie di cabinati e container, aventi medesime caratteristiche e dimensioni (Tabella 3-11)

Tali strutture saranno utilizzate come:

- Laboratorio
- Uffici
- Stoccaggio materiali
- Infermeria
- Servizi igienici
- Cabina di guardia
- Misurazioni fiscali e Analizzatori



FIGURA 3-31: ESEMPIO DI CABINATO

TABELLA 3-11: CARATTERISTICHE DEI CABINATI E CONTAINER		
UNITA'	DESCRIZIONE	PESO E DIMENSIONI PRELIMINARI (m)(LxLxH)
510	LABORATORY PACKAGE	6x2,4x2,6 5 Ton
620	WAREHOUSE CABIN	6x2,4x2,6 5 Ton
630	WORKSHOP CABIN	6x2,4x2,6 5 Ton
680	OFFICE CABIN	6x2,4x2,6 5 Ton
700	MATERIAL STOCK CONTAINER	6x2,4x2,6 5 Ton
710	INFIRMARY CABIN	6x2,4x2,6 5 Ton
720	TOILET CABIN	6x2,4x2,6 5 Ton
750	GUARD CABIN	6x2,4x2,6 5 Ton
780	FISCAL MEETERING PACKAGE	6x2,4x2,6 5 Ton
490	INLINE ANALYZERS (490)	TBD

3.5 Sistema di illuminazione

Il sistema di illuminazione prevede torri faro per l'illuminazione generale dell'impianto (posti nelle aree perimetrali prossime alla recinzione) e fari led per l'illuminazione localizzata di qualsiasi equipment.

I fari led sono dotati di vetro piatto di protezione che assicura un'illuminazione rispettosa delle norme per l'ambiente circostante: l'angolo luce (viewing angle) è pari a 60°.

3.6 Informazioni sulla gestione e manipolazione dei prodotti e sottoprodotti

3.6.1 Anidride Carbonica

La CO₂ recuperata nel processo all'interno dell'Unità di recupero e trattamento Gas Acidi (Unità 360) può essere opportunamente sfruttata sul mercato industriale, imbottigliata allo stato gassoso o liquido, evitandone l'immissione in atmosfera, in un quadro globale di riduzione delle emissioni di gas serra.

Approfondimento 1 - Caratteristiche chimiche dell'anidride carbonica (CO₂)

La CO₂ è incombustibile, chimicamente stabile in condizioni atmosferiche e poco reattiva.

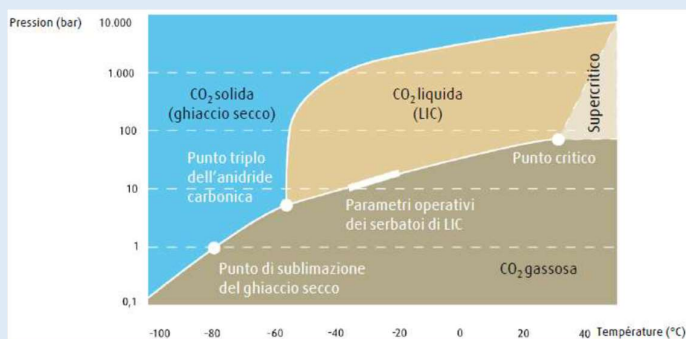
Sotto forma di gas in condizioni atmosferiche è circa 1,5 volte più pesante dell'aria: per questa ragione la CO₂ scende prevalentemente verso il basso e si può raccogliere in pozzi, cantine o depressioni del terreno.

Quando la circolazione dell'aria è scarsa, questi accumuli di CO₂ possono perdurare per molte ore.

Gli stati di aggregazione che dipendono dalla pressione e dalla temperatura richiedono una particolare attenzione:

- In condizioni atmosferiche la CO₂ è gassosa.
- A temperature comprese tra -56,6 e +31,1°C e pressioni di almeno 5,2 bar, la CO₂ può assumere la forma liquida. A pressione atmosferica (1 bar) l'anidride carbonica non può assumere la forma liquida.
- A temperature inferiori a -56,6°C la CO₂ può assumere la forma solida.

Tutti e tre gli stati di aggregazione sono possibili solo in corrispondenza del cosiddetto punto triplo (-56,6°C, 5,2 bar).



Considerando la capacità produttiva giornaliera di circa 3,63 ton/g, si prenderà in considerazione uno stoccaggio criogenico di 10 m³, equivalente a 2/3 giorni di produzione.

Le condizioni di conservazione sono in fase liquida a circa -15 °C.

TABELLA 3-12: QUADRO SINOTTICO DELLA CAPACITÀ DI RECUPERO DELLA CO₂

Portata massica	151,2 Kg/h
Portata volumetrica in condizioni standard	77 Nm ³ /h
Pressione	22 barg
Temperatura	-14.24 °C
% mol CO ₂	> 99.5%
Funzionamento annuale in continuo	8.000 ore
Capacità annua di produzione della CO ₂	1209,6 tonnellate
Capacità di stoccaggio CO ₂	10 m ³ (equivalente a 2/3 giorni di produzione)
Baie di carico	N° 1 baia di carico liquida
Numero di cisterne al giorno	N°1 cisterna ogni 5 giorni circa



FIGURA 3-32: STOCCAGGIO CRIOGENICO DELLA CO₂ (VOLUME 50 m³)

La CO₂ prodotta dal sistema di recupero RPB sarà destinata all'uso **industriale** e caricato su autocisterne "TO TRUCK" allo stato liquido.

FIGURA 3-33: TRASPORTO DELLA CO₂

3.6.2 Cattura dell'H₂S

Dall'Unità di recupero e trattamento Gas Acidi (Unità 360), attraverso le migliori tecnologie disponibili (BAT), si procederà alla cattura del H₂S contenuto nei gas acidi (circa 1 ton/giorno) attraverso l'utilizzo di trappole catalitiche costituite da serbatoi riempiti con materiale granulare a base di ossido metallico misto poroso su una base igroscopica stabile. Il riempimento catalitico è licenziato ed idoneo alla rimozione dello zolfo presente nella corrente gassosa. La corrente di gas a valle del suddetto trattamento raggiunge un contenuto finale inferiore a 100ppb (max). Per rendere possibile le operazioni di sostituzione del solido catalitico e permettere al contempo il funzionamento dell'impianto in continuo, si utilizzano 2 letti catalitici, di cui uno operativo, l'altro in rigenerazione.

3.6.3 Acqua di produzione (Sottoprodotto)

La quantità stimata di acqua di produzione da trattare è pari a 17,7 m³/giorno.

L'Acqua di produzione associata al gas estratto dai pozzi MP1 e MP2 verrà opportunamente separata dal gas nelle apparecchiature dell'impianto e convogliata ad una specifica unità di trattamento (Unità 530) dove sarà portata a specifiche di legge per essere convogliata a serbatoio di stoccaggio per riutilizzo interno all'impianto stesso per i sistemi di processo e antincendio.

3.7 Viabilità utilizzata per il trasporto dell'LNG e dei sottoprodotti

Come anticipato precedentemente Small Scale LNG Plant sorgerà nella Regione Abruzzo, in provincia di Chieti nel territorio del comune di Bomba, riconducibile allo sviluppo del campo Monte Pallano ovvero alla messa in produzione dei pozzi esistenti Monte Pallano 1 e Monte Pallano 2. Il sito è costeggiato dalla SS 652, arteria principale che collega l'interno del Molise alla costa adriatica, attraversando la val di Sangro e terminando nel comune di Fossacesia, in Abruzzo. Questa infrastruttura viaria rappresenta una, se non l'unica, infrastruttura viaria idonea al trasporto iniziale del prodotto finale GNL, per mezzo di autocisterne in una qualsiasi destinazione di interesse.

Infatti, per mezzo della SP 652 è possibile raggiungere perfettamente:

- il **Distretto Industriale Val di Sangro**, cuore Industriale della Regione Abruzzo (Distanza totale: 20 Km - Tempo di percorrenza: 18 min) (Figura 3-34).
- l'**Autostrada Adriatica A14** per la veicolazione del prodotto in qualsiasi direzione del territorio nazionale italiano (Distanza totale: 25 Km - Tempo di percorrenza: 22 min) (Figura 3-35).

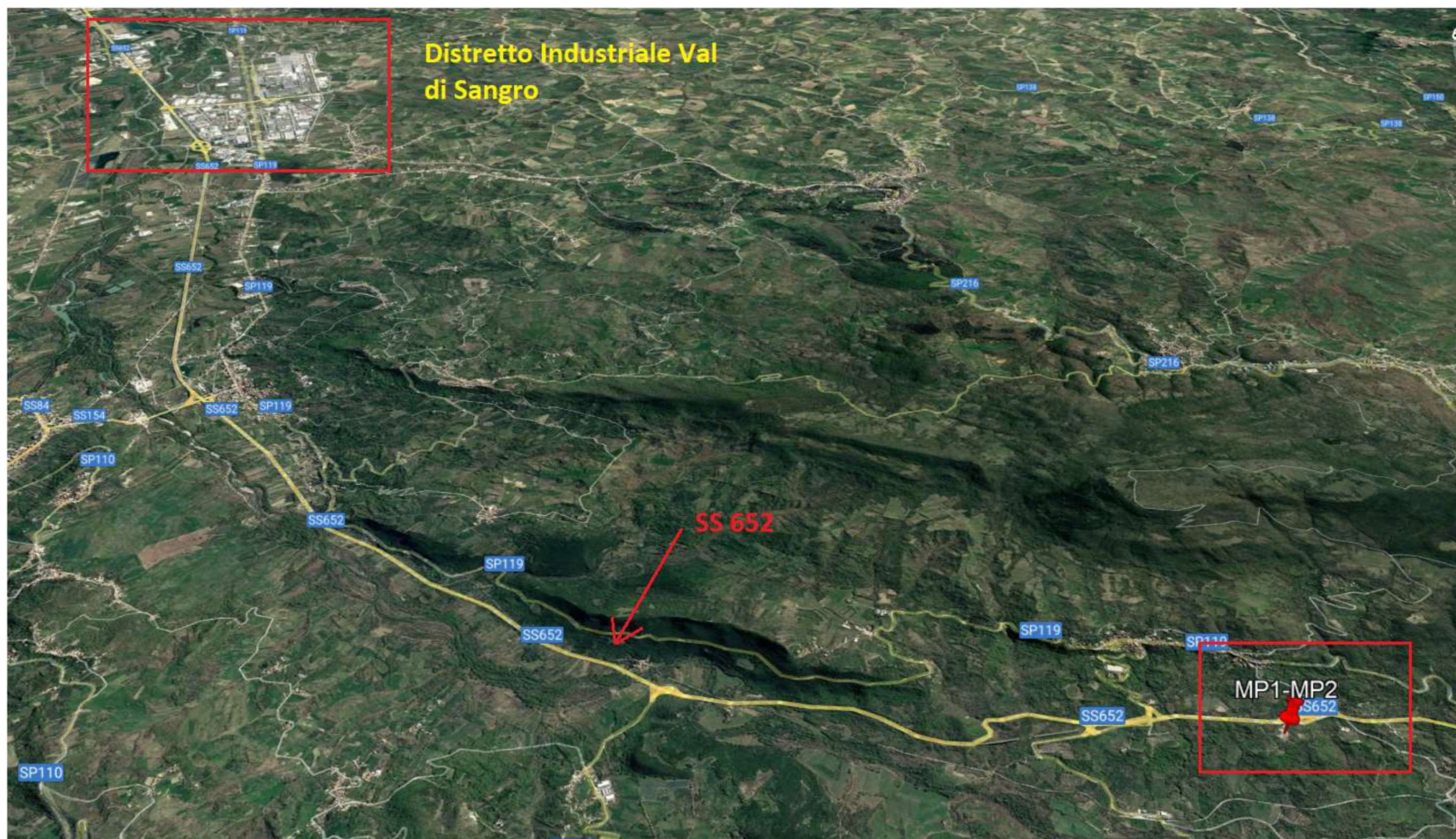


FIGURA 3-34: RAGGIUNGIMENTO DISTRETTO VAL DI SANGRO

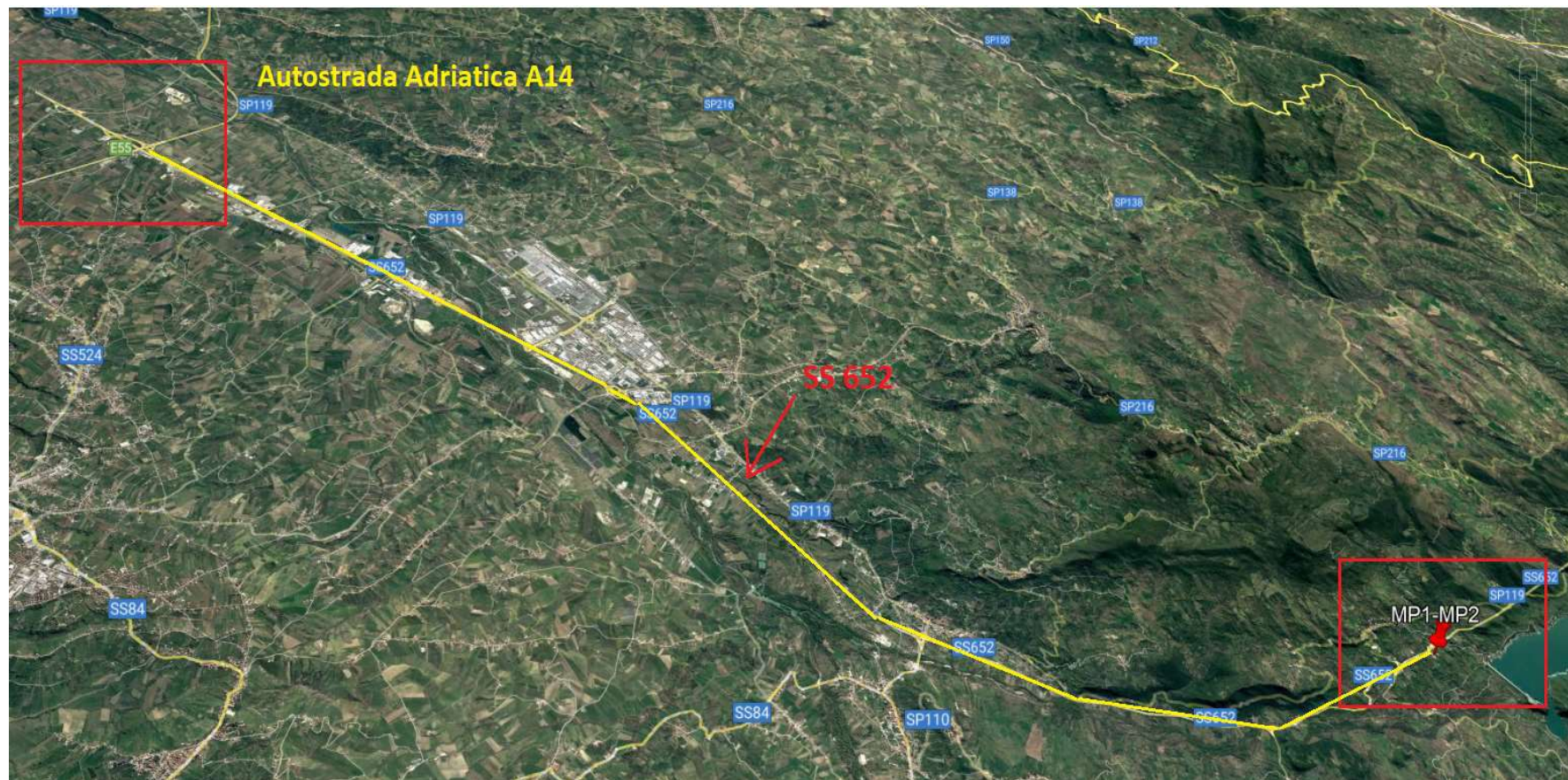


FIGURA 3-35: RAGGIUNGIMENTO SVINCOLO AUTOSTRADA ADRIATICA A14

4 CONDIZIONI AMBIENTALI

Parametro	Unità di misura	Minimo	Massimo
Velocità del vento	m/s	-	50
Direzione prevalente del vento	Punto cardinale	Nord - Ovest	
Pioggia	mm/giorno	0	100
Pressione barometrica	mbar	900	1000
Temperatura ambiente	°C	1	29
Umidità	%	15	70
Altitudine	m s.l.m.	424	

4.1 Temperature di progetto

Le temperature ambientali considerate nella progettazione di fattibilità dell'impianto sono indicate di seguito:

Massima temperatura di bulbo secco di progetto (Estate)	45°C più radiazione solare
Massima temperatura di bulbo secco di progetto (Inverno)	-15°C
temperatura di bulbo secco di progetto per gli air coolers in critical utility service	45°C
Temperatura di bulbo secco di progetto per gli air cooler in critical process service	45°C
Temperatura di progetto per gli e-motor	45°C

Relativamente alle condizioni di temperatura minime ambientali nel periodo invernale si prevede apposita procedura di "Winterizzazione" per le apparecchiature, tubazioni e strumentazione.

4.2 Dati sismici

Secondo la classificazione sismica istituita dall'Ordinanza n. 3274 del D.P.C.M. del 20 Marzo 2003 "Primi elementi in materia di criteri generali per la classificazione sismica del territorio nazionale e normative tecniche per le costruzioni in zona sismica" il territorio italiano risulta suddiviso in 4 Zone a diverso livello di pericolosità sismica:

- Zona 1 - sismicità alta (PGA oltre 0,25 g)
- Zona 2 - sismicità medio-alta (PGA fra 0,15 e 0,25 g)
- Zona 3 - sismicità medio-bassa (PGA fra 0,05 e 0,15 g)
- Zona 4 - sismicità bassa (PGA inferiore a 0,05 g)

L'area interessata dal Progetto di Small Scale LNG è classificata come Zona 2, in cui sono possibili forti terremoti.

4.3 Codici e Standard di riferimento

Le facilities dello Small Scale LNG sono progettate in accordo agli standard e norme tecniche internazionali, come di seguito riportate.

Per alcune apparecchiature di tecnologia proprietaria si fa riferimento ai "manufacturer standard" e criteri di know-how proprietario.

EN:	Norma europea
API:	American Petroleum Institute
ASME:	American Society of Mechanical Engineers
ANSI:	American National Standard Institute
IEC:	International Electro Technical Commission
ASTM:	American Society of Testing and Materials
NFPA:	National Fire Protection Association
ISO:	International Organization of Standardization
ISA:	Instrument Society of America
CEI:	Comitato Elettrotecnico Italiano
CEN:	European Committee for Standardization (EN)
CENELEC:	European Committee for Electro-technical Standardization
IEEE:	Institute of Electrical and Electronic Engineers
NACE:	National Association of Corrosion Engineers
NEC:	National Electrical Code (USA)

GPSA:	Gas Processors Suppliers Association (Engineering Data Book)
ATEX:	Direttiva Europea 94/9/CE
PED:	97/23/CE Directive CEE pour équipements en pression
TEMA:	Heat exchangers
API 619:	Gas compression units
API RP 520:	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries, Part1 "Design" and Part2 "Installation"
API RP 521:	Guide for pressure-relieving and depressuring systems
API RP 526:	Flanged steel pressure Relief Valve
API 620:	Design and Construction of Large, Welded, Low-pressure Storage Tanks
API 676:	Oil pumps
ASME B 31.3:	Process Piping
ASME B 31.5:	Refrigerated process piping
NFPA 10:	Portable fire extinguisher
NFPA 11:	Foam extinguishing systems
NFPA 16	Foam-Water sprinklers and spray systems
NFPA 59A:	Standard for the production, storage and handling of Liquefied Natural Gas
EN1473:	Installation and equipment for liquefied N.G. – design of onshore installations
EN1160:	Installation and equipment for liquefied N.G. – general characteristics of liquefied Natural Gas
EN14620:	Design and manufacture of site built, vertical cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases...
EN1474:	Installation and equipment for LNG – Design and testing of LNG loading/unloading arms

4.4 Unità di misura

Per la progettazione è stato utilizzato il sistema di unità di misura internazionale SI, ad eccezione del dimensionamento delle tubazioni in cui si è adoperato lo standard ANSI.

Pressione	barg
Pressione (assoluta)	bara
Pressure drop	bar
Temperatura	°C
Massa, Peso	kg, ton
Portata di sostanza	kmol/h, m3/h
Peso molecolare	kg/kmol, g/mol
Densità	kg/m3
Concentrazione	ppm_mol, ppmv, ppmw, ppbw, mg/l, % weight
Capacità di produzione di gas	MMSCMD (milioni di standard metri cubi al giorno), MMSCFD (milioni di standard piedi cubi al giorno)
Capacità di produzione di liquido	m3/day (metri cubi al giorno)
Volume	m3, barrel (for oil)
Portata di gas e vapore	Sm3/d (standard metri cubi al giorno), Sm3/h (standard metri cubi all'ora), Nm3/h (normal metri cubi all'ora), am3/h (metri cubi effettivi all'ora),
Potenza termica	kW, kcal/h, BTU/hr
Potenza elettrica	MW, kW
Entalpia	kJ/kg, kcal/kg
Coefficiente di scambio termico	W/(m2*°C), kcal/(h*°C*m2), Btu/(h*°F*ft2),
Viscosità (dinamica)	cP
Lunghezza	km, m, mm
Area	m2
Pipe Diameter	in
Tubing Size	mm
Vessel Nozzles	in
Velocità	m/s
Intensità acustica	dB(A)
Tempo	h (ora), min (minuto), s (secondo), d (giorno)
Condizioni normali: 1.013 bara e 0°C	
Condizioni Standard: 14.696 psia (1.013 bara) e 60°F (15.5°C)	

IMPIANTO SMALL SCALE LNG PLANT

Collesanto gas field

BILANCIO DI MATERIA ED ENERGIA

	01	14.11.2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	00	04.10.2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
	Rev. Indice					
CONTRATTATORE				Titolo Progetto		
 Engea Consulting						
 DG Impianti						
 ITALFLUID Cosmep				IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field		
CLIENTE						
 LNEnergy						
				Scala	foglio/di	
				A4	1	2
Titolo Documento				Doc. Codice		
				-		
				Doc. Pos		
BILANCIO DI MATERIA ED ENERGIA				-		
Software: Microsoft Excel				File name		

ENGEA LNENERGY ITALFLUID COSMEP Engineering Management Contracting					IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field																									Date	14/11/2023		
																														Rev.	01		
																														SHEET	2 / 2		
	RG1	RG2	RG3	RG4	SG1	SG2	SG3	SG4	G1	LNG	LNG1	LNG2	BOG	OW3	OW4	OW5	OW6	TW	NGL1	NGL2	FG1	FG2	FG	Flue gas	Acid Gas	Gas di coda	Scarico atm	N2	POTABLE WATER	H2	O2	Spurgo	
Vapour Fraction	1.000	1.000	1.000	1.000	1.000	1.000	0.998	1.000	1.000	0.000	0.051	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.318	0.845	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.000	
Temperature C	40.0	40.0	40.0	46.0	50.1	44.0	20.0	20.0	24.7	-155.0	-161.2	-161.2	-161.2	20.0	31.1	59.0	55.1	42.2	-65.0	-88.8	4.3	101.8	75.6	318.9	43.1	35.5	999.1	25.0	25.0	30.0	82.0	25.0	
Pressure bar_g	50.0	50.0	50.0	49.5	48.8	48.3	48.0	48.0	47.2	24.7	0.1	0.1	0.1	48.0	3.0	47.2	3.0	0.0	45.2	11.0	10.7	11.0	10.5	0.1	1.2	0.0	0.0	0.7	0.0	28.2	0.0	0.0	
Mass Flow kg/h	10366.5	10366.5	10366.5	10366.5	10165.2	10165.2	10165.2	10146.3	10109.9	5908.2	5908.2	5600.9	307.2	18.9	45.4	354.6	419.0	733.5	1371.0	1371.0	1383.7	307.2	1690.9	41754.3	199.5	11.4	354.5	2835.3	568.6	17.7	141.5	314.6	
Heat Flow kW	-8813.2	-8813.2	-8813.2	-8776.3	-8379.2	-8416.1	-8567.4	-8483.7	-8406.4	-8608.2	-8608.2	-8251.3	-356.9	-83.7	-200.1	-1549.8	-1833.6	-3222.1	-1295.4	-1295.4	-1155.2	-313.0	-1381.9	-16929.2	-399.4	-14.9	-14.0	-21.5	-2509.3	0.3	2.1	-1388.5	
Std Gas Flow STD_m3/d	283012.7	283012.7	283012.7	283012.7	280246.6	280246.6	280246.6	279649.9	278625.3	195993.6	195993.6	185969.9	10023.7	596.7	1430.6	11169.1	13196.4	23105.5	25194.0	25194.0	25520.6	10023.7	35544.3	835532.8	2808.0	290.1	6793.9	57681.0	17909.7	4979.4	2509.4	9910.1	
Actual Liquid Flow m3/d	0.00	0.00	0.00	0.00	0.00	0.08	0.45	0.00	0.00	323.67	302.58	302.58	0.00	0.45	1.09	8.66	10.21	17.71	65.82	45.55	15.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.55	0.00	0.00	7.50	
Specific Gravity rel Air rel_to_air	0.72	0.72	0.72	0.72	0.71	-	-	0.71	0.71	-	-	-	0.60	-	-	-	-	-	-	-	-	0.60	0.93	0.98	1.39	0.77	1.02	0.96	-	0.07	1.10	-	
Molecular Weight	20.8	20.8	20.8	20.8	20.6	20.6	20.6	20.6	20.6	17.1	17.1	17.1	17.4	18.0	18.0	18.0	18.0	18.0	30.9	30.9	30.8	17.4	27.0	28.4	40.3	22.2	29.6	27.9	18.0	2.0	32.0	18.0	
Composition mole%	RG1	RG2	RG3	RG4	SG1	SG2	SG3	SG4	G1	LNG	LNG1	LNG2	BOG	OW3	OW4	OW5	OW6	TW	NGL1	NGL2	FG1	FG2	FG	Flue gas	Acid Gas	Gas di coda	Scarico atm	N2	POTABLE WATER	H2	O2	Spurgo	
H2S	0.269	0.269	0.269	0.269	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	24.984	0.181	0.000	0.000	0.000	0.000	0.000	0.000	
CO2	0.699	0.699	0.699	0.699	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.003	0.002	0.000	0.000	0.000	0.000	0.000	6.552	70.131	9.052	4.609	0.000	0.000	0.000	0.000	0.000	
Nitrogen	21.322	21.322	21.322	21.322	21.525	21.525	21.525	21.571	21.585	1.002	1.002	0.449	11.262	0.014	0.000	0.009	0.008	0.001	3.675	3.675	3.868	11.262	5.953	75.131	0.036	7.798	46.534	98.999	0.000	0.000	0.000	0.000	0.000
Methane	69.083	69.083	69.083	69.083	69.694	69.694	69.694	69.843	69.889	93.405	93.405	93.658	88.729	0.000	0.000	0.000	0.000	0.000	45.456	45.456	45.719	88.729	57.848	0.000	0.817	68.363	0.000	1.001	0.000	0.000	0.000	0.000	
Ethane	4.936	4.936	4.936	4.936	4.976	4.976	4.976	4.987	4.990	4.589	4.589	4.836	0.009	0.000	0.000	0.000	0.000	0.000	19.556	19.556	19.398	0.009	13.930	0.000	0.175	7.510	0.000	0.000	0.000	0.000	0.000	0.000	
Propane	2.238	2.238	2.238	2.238	2.257	2.257	2.257	2.262	2.263	0.884	0.884	0.932	0.000	0.000	0.000	0.000	0.000	0.000	18.162	18.162	17.990	0.000	12.917	0.000	0.072	2.747	0.000	0.000	0.000	0.000	0.000	0.000	
i-Butane	0.340	0.340	0.340	0.340	0.342	0.342	0.342	0.343	0.343	0.056	0.056	0.059	0.000	0.000	0.000	0.000	0.000	0.000	3.364	3.364	3.331	0.000	2.392	0.000	0.022	0.548	0.000	0.000	0.000	0.000	0.000	0.000	
n-Butane	0.510	0.510	0.510	0.510	0.514	0.514	0.514	0.515	0.515	0.055	0.055	0.058	0.000	0.000	0.000	0.000	0.000	0.000	5.271	5.271	5.220	0.000	3.748	0.000	0.016	0.576	0.000	0.000	0.000	0.000	0.000	0.000	
i-Pentane	0.120	0.120	0.120	0.120	0.121	0.121	0.121	0.121	0.121	0.005	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000	1.304	1.304	1.291	0.000	0.927	0.000	0.003	0.113	0.000	0.000	0.000	0.000	0.000	0.000	
n-Pentane	0.100	0.100	0.100	0.100	0.101	0.101	0.101	0.101	0.101	0.003	0.003	0.003	0.000	0.000	0.000	0.000	0.000	0.000	1.097	1.097	1.086	0.000	0.780	0.000	0.004	0.120	0.000	0.000	0.000	0.000	0.000	0.000	
n-Hexane	0.130	0.130	0.130	0.130	0.131	0.131	0.131	0.131	0.131	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	1.446	1.446	1.431	0.000	1.028	0.000	0.006	0.162	0.000	0.000	0.000	0.000	0.000	0.000	
n-Heptane	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.061	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.669	0.669	0.663	0.000	0.476	0.000	0.003	0.080	0.000	0.000	0.000	0.000	0.000	0.000	
n-Octane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
H2O	0.192	0.192	0.192	0.192	0.278	0.278	0.278	0.066	0.000	0.000	0.000	0.000	0.000	99.986	99.958	99.991	99.987	99.997	0.000	0.000	0.001	0.000	0.001	10.249	3.731	2.750	7.775	0.000	100.000	0.000	0.000	100.000	
Oxygen	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8.068	0.000	0.000	41.035	0.000	0.000	0.000	100.000	0.000	0.000	
Hydrogen	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	100.0000	0.0000	0.0000	0.0000	

IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field

ELENCO APPARECCHIATURE

	01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	00	09/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
	Rev. Indice					
CONTRATTATORE				Titolo Progetto		
   Engea Consulting DG Impianti ITALFLUID Cosmep						
CLIENTE				IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field		
 LNEnergy						
				Scala	foglio/di	
				A4	1	di 2
Titolo Documento				Doc. Codice		
				Doc. Pos		
ELENCO APPARECCHIATURE						
Software: Microsoft Excel				File name 0		

ENEA Consulting		ENEA Consulting																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field

Elenco dei consumi di chimici, materiali consumabili e commodities

	01	07/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
-	00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
	Rev. Indice					
CONTRATTATORE  Engea Consulting  DG Impianti  ITALFLUID Cosmep				Titolo Progetto IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field		
CLIENTE  LNEnergy LNEnergy						
				Scala	foglio/di	
				A4	1	di 3
Titolo Documento				Doc. Codice		
				Doc. Pos		
Elenco dei consumi di chimici, materiali consumabili e commodities						
Software: Microsoft Excel						
				File name		0

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep							
			01	07/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNEnergy	CLIENTE	REV.	DATA	Elenco dei consumi di chimici, materiali consumabili	ELABORATO	VERIFICATO	APPROVATO
Lista Consumabili, Chemicals & Commodities		U.M.	Quantità		Modalità di gestione			
AMMINE - Ammine		Kg	23450		Primo caricamento dell'impianto. Si prevede uno spurgo annuale del 20% che va inviato a smaltimento presso Fornitore autorizzato. (Nota 1)			
ANTIFOAM - Antischiumogeno		Kg	200		Consumo annuale di chimico che viene iniettato nel processo produttivo. (Nota 2)			
OXYGEN SCAVENGER - Sequestrante Ossigeno		Kg	200		Consumo annuale di chimico che viene iniettato nel processo produttivo. (Nota 2)			
CORROSION INHIBITOR - Ibrnibitore di corrosione		Kg	200		Consumo annuale di chimico che viene iniettato nel processo produttivo. (Nota 2)			
Molecular Sieve for Dehydration - Setaccio molecolare per la disidratazione		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
Adsorbent HG removal - Assorbenti rimozione Mercurio		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
LUBRICANT FOR OIL FLOODED SCREW COMPRESSOR - lubrificante per compressore a vite - Unità 380 (S-361, S362)		Kg	20000		Primo caricamento dell'impianto. Si prevede uno spurgo annuale del 30% che va inviato a smaltimento presso Fornitore autorizzato. (Nota 1)			
GREASE FOR MAIN MOTOR BEARIGNS - grasso per cuscinetti dei principali motori		Kg	320		Consumo annuale di grasso che viene consumato dalle macchine rotanti presenti in impianto.			
AMMONIA CHARGE - Caricamento Ammoniacca		Kg	2000		Primo caricamento dell'impianto. Si prevede uno spurgo annuale del 20% che va inviato a smaltimento presso Fornitore autorizzato. (Nota 1)			
MIX REFRIGERANT - Refrigerante multicomponente		Kg	4500		Primo caricamento dell'impianto. Si prevede uno spurgo annuale del 20% che va inviato a smaltimento presso Fornitore autorizzato. (Nota 1)			
ORS Adsorbant Material - (Oil Removal System) Materiale assorbente per la rimozione tracce olio dal gas - Unità 380 (S-361, S362)		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
ORS Charcoal - carboni per rimozione tracce olio - Unità 380 (S-361, S362)		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
HOT OIL (THERMINOL or DOWTHERM)		LT	4000		Primo caricamento dell'impianto. Si prevede uno spurgo annuale del 20% che va inviato a smaltimento presso Fornitore autorizzato (Nota 1)			
Molecular sieve for Air Separation - Setacci molecolari per separazione aria		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
Molecular sieve for Nitrogen Generation - setacci molecolari per generazione Azoto		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
DIESEL for Start-up/ EDG- Diesel per start up/ Generatore Diesel di emergenza		LT	2000		Stima del quantitativo di combustibile DIESEL consumato annualmente durante evetuali emergenze e fermi impianto per la produzione di energia elettrica di emergenza.			
Riempimento granulare a base di ossido di metallo per cattura H2S		Kg	30000		Nell'unità di Recupero & Trattamento dei Gas Acidi , attraverso le migliori tecnologie disponibili (BAT), si procederà alla cattura della H2S contenuta nel gas estratto dai pozzi esistenti MP1 & MP2 (circa 1 ton/giorno) attraverso l'utilizzo di trappole catalitiche costituite da uno o più serbatoi riempiti con materiale granulare a base di ossido metallico misto poroso su una base igroscopica stabile. Il riempimento catalitico è licenziato ed idoneo alla rimozione della zolfo presente nella corrente gassosa. La corrente di gas a valle del suddetto trattamento raggiunge un contenuto finale inferiore a 100ppb (max), utile al successivo trattamento di recupero e purificazione della CO2. Quantitativo di solido catalitico assorbente che viene rigenerato e riutilizzato mensilmente presso Fornitore qualificato.			
Riempimento di Allumina - (Unità 360- SKID XX-352 - Essiccatori)		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
Riempimento ai Carboni Attivi (Unità 360- SKID XX-352 - Purificatori)		Kg	1000		Quantitativo di solido assorbente che viene sostituito annualmente ed inviato a smaltimento presso Fornitore autorizzato.			
Freon (Unità 360)		Kg	2000		Primo caricamento dell'impianto. Si prevede una perdita annuale del 1% che va ricaricata nel circuito frigorifero. (Nota 3)			

  	ENGEA Consulting	CONTRATTORE							
	DG impianti								
	ITALFLUID Cosmep								
	01		07/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep		
	00		06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep		
	LNEnergy	CLIENTE	REV.	DATA	Note al documento : Elenco dei consumi di chimici, materiali consumabili e commodities	ELABORATO	VERIFICATO	APPROVATO	
(Nota 1)	Spurghi annuali inviati presso fornitore autorizzato: AMMINE 4690 Kg LUBRIFICANTE PER COMPRESSORE A VITE 6000 Kg AMMONIACA 400 Kg MIX REFRIGERANT 900 Kg HOT OIL 800 Kg								
(Nota 2)	Le schede di sicurezza dei chimici utilizzanti nell'impianto (Antischiumogeno, Inibitore di corrosione e Sequestrante di O2) sono riportate nell'Allegato 1 al presente documento								
(Nota 3)	Perdita annuale di Freon da ricaricare nel circuito frigorifero stimata pari a 20 Kg								

IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field

Allegato 1 - Schede Sicurezza Chimici Impianto

Elenco dei consumi di chimici, materiali consumabili e commodities

-	01	07/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
-	00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
	Rev. Indice					
CONTRATTORE  Engea Consulting  Engineering Management Contracting  ITALFLUID Cosmep				Titolo Progetto IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field		
CLIENTE  LNEnergy						
				Scala	foglio/di	
				A4	1	di 1
Titolo Documento Allegato 1 Elenco dei consumi di chimici, materiali consumabili e commodities				Doc. Codice		
				Doc. Pos		
Software: Microsoft Excel						
File name				0		

SAFETY DATA SHEET

Antifoam agent, Antifoam 1520, Part Number 5190-2235

Section 1. Identification

1.1 Product identifier

Product name : Antifoam agent, Antifoam 1520, Part Number 5190-2235
Part no. : 5190-2235
Validation date : 5/19/2023

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Reagents and Standards for Analytical Chemistry Laboratory Use
10 ml

1.3 Details of the supplier of the safety data sheet

Supplier/Manufacturer : Agilent Technologies, Inc.
5301 Stevens Creek Blvd
Santa Clara, CA 95051, USA
800-227-9770

1.4 Emergency telephone number

In case of emergency : CHEMTREC®: 1-800-424-9300

Section 2. Hazards identification

2.1 Classification of the substance or mixture

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture

H319 EYE IRRITATION - Category 2A
Percentage of the mixture consisting of ingredient(s) of unknown hazards to the aquatic environment: 10%

2.2 GHS label elements

Hazard pictograms :



Signal word : Warning
Hazard statements : H319 - Causes serious eye irritation.

Precautionary statements

Prevention : P280 - Wear eye or face protection.
Response : P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313 - If eye irritation persists: Get medical advice or attention.

Storage : Not applicable.

Disposal : Not applicable.

2.3 Other hazards

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Mixture

Ingredient name	%	CAS number
Siloxanes and Silicones, di-Me	≥10 - <25	63148-62-9
benzoic acid	<1	65-85-0

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

4.1 Description of necessary first aid measures

- Eye contact** : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.
- Inhalation** : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
- Skin contact** : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
- Ingestion** : Wash out mouth with water. Remove dentures if any. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention if adverse health effects persist or are severe. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

4.2 Most important symptoms/effects, acute and delayed

Potential acute health effects

- Eye contact** : Causes serious eye irritation.
- Inhalation** : No known significant effects or critical hazards.
- Skin contact** : No known significant effects or critical hazards.
- Ingestion** : No known significant effects or critical hazards.

Over-exposure signs/symptoms

- Eye contact** : Adverse symptoms may include the following:
pain or irritation
watering
redness
- Inhalation** : No specific data.
- Skin contact** : No specific data.
- Ingestion** : No specific data.

4.3 Indication of immediate medical attention and special treatment needed, if necessary

Date of issue : 05/19/2023

2/11

Section 4. First aid measures

- Notes to physician** : Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
- Specific treatments** : No specific treatment.
- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

5.1 Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.

5.2 Special hazards arising from the substance or mixture

- Specific hazards arising from the chemical** : In a fire or if heated, a pressure increase will occur and the container may burst.
- Hazardous thermal decomposition products** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
metal oxide/oxides
Formaldehyde.

5.3 Advice for firefighters

- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.
- Special protective equipment for fire-fighters** : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- For non-emergency personnel** : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
- For emergency responders** : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

6.2 Environmental precautions

- : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

6.3 Methods and materials for containment and cleaning up

- Methods for cleaning up** : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Section 7. Handling and storage

7.1 Precautions for safe handling

- Protective measures** : Put on appropriate personal protective equipment (see Section 8). Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.
- Advice on general occupational hygiene** : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

- : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. See Section 10 for incompatible materials before handling or use.

7.3 Specific end use(s)

- Recommendations** : Industrial applications, Professional applications.
- Industrial sector specific solutions** : Not available.

Section 8. Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Siloxanes and Silicones, di-Me benzoic acid	None. ACGIH TLV (United States, 1/2022). Absorbed through skin. TWA: 0.5 mg/m ³ 8 hours. Form: Inhalable fraction and vapor

Biological exposure indices

No exposure indices known.

8.2 Exposure controls

- Appropriate engineering controls** : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.
- Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

- Hygiene measures** : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Section 8. Exposure controls/personal protection

- Eye/face protection** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.
- Skin protection**
- Hand protection** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
- Body protection** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Other skin protection** : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory protection** : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use.

Section 9. Physical and chemical properties and safety characteristics

The conditions of measurement of all properties are at standard temperature and pressure unless otherwise indicated.

Appearance

- Physical state** : Liquid. [Emulsion.]
- Color** : Milky white
- Odor** : Characteristic.
- Odor threshold** : Not available.
- pH** : 3.5
- Melting point/freezing point** : Not available.
- Boiling point, initial boiling point, and boiling range** : 65°C (149°F)
- Flash point** : Closed cup: >101.1°C (>214°F)
- Evaporation rate** : Not available.
- Flammability** : Not applicable.
- Lower and upper explosion limit/flammability limit** : Not available.
- Vapor pressure** :

Ingredient name	Vapor Pressure at 20°C			Vapor pressure at 50°C		
	mm Hg	kPa	Method	mm Hg	kPa	Method
Water	17.5	2.3		92.258	12.3	
Siloxanes and Silicones, di-Me	5	0.67				

- Relative vapor density** : Not available.
- Relative density** : 1
- Density** : 1 g/cm³ [25°C (77°F)]

Section 9. Physical and chemical properties and safety characteristics

Solubility(ies)	:	Media	Result
	:	Water	Soluble

Miscible with water : Yes.

Partition coefficient: n-octanol/water : Not applicable.

Auto-ignition temperature : Not available.

Decomposition temperature : Not available.

Viscosity : Kinematic: 5000 mm²/s (5000 cSt)

Particle characteristics

Median particle size : Not applicable.

Section 10. Stability and reactivity

10.1 Reactivity : No specific test data related to reactivity available for this product or its ingredients.

10.2 Chemical stability : The product is stable.

10.3 Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

10.4 Conditions to avoid : No specific data.

10.5 Incompatible materials : May react or be incompatible with oxidizing materials.

10.6 Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
benzoic acid	LD50 Oral	Rat	1700 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Siloxanes and Silicones, di-Me	Eyes - Mild irritant	Rabbit	-	1 hours 100 mg	-
	Eyes - Mild irritant	Rabbit	-	24 hours 100 uL	-
	Eyes - Moderate irritant	Rabbit	-	24 hours 100 uL	-
	Skin - Mild irritant	Rabbit	-	24 hours 500 uL	-
benzoic acid	Skin - Mild irritant	Human	-	40 minutes 0.76 %	-
	Skin - Moderate irritant	Human	-	72 hours 22 mg l	-

Sensitization

Not available.

Mutagenicity

Section 11. Toxicological information

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
benzoic acid	Category 3	-	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
benzoic acid	Category 1	inhalation	lungs

Aspiration hazard

Not available.

Information on the likely routes of exposure :  Routes of entry anticipated: Oral, Dermal, Inhalation, Eyes.

Potential acute health effects

Eye contact : Causes serious eye irritation.
Inhalation : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
 pain or irritation
 watering
 redness
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Potential chronic health effects

General : No known significant effects or critical hazards.

Section 11. Toxicological information

- Carcinogenicity** : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Reproductive toxicity : ☒ No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Product/ingredient name	Oral (mg/kg)	Dermal (mg/kg)	Inhalation (gases) (ppm)	Inhalation (vapors) (mg/l)	Inhalation (dusts and mists) (mg/l)
benzoic acid	1700	N/A	N/A	N/A	N/A

Section 12. Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Siloxanes and Silicones, di-Me benzoic acid	Acute LC50 44.5 ppm Fresh water	Daphnia - Daphnia magna - Instar	48 hours
	Acute EC50 140 µg/l	Algae - Chlorella vulgaris - Exponential growth phase	72 hours
	Acute EC50 860 mg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 180 ppm Fresh water	Fish - Gambusia affinis - Adult	96 hours

12.2 Persistence and degradability

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
benzoic acid	-	-	Readily

12.3 Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
benzoic acid	1.88	-	low

12.4 Mobility in soil

- Soil/water partition coefficient (K_{oc})** : Not available.

- 12.5 Other adverse effects** : No known significant effects or critical hazards.

Section 13. Disposal considerations

13.1 Waste treatment methods

- Disposal methods** : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered

Section 13. Disposal considerations

when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

The information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

Section 14. Transport information

DOT / TDG / Mexico / IMDG / IATA : Not regulated.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to IMO instruments : Not available.

Section 15. Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

U.S. Federal regulations : **TSCA 8(a) PAIR:** Siloxanes and Silicones, di-Me; Siloxanes and Silicones, di-Me, reaction products with silica

TSCA 8(a) CDR Exempt/Partial exemption: Not determined

Clean Water Act (CWA) 311: benzoic acid; Sulphuric acid

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

Name	%	EHS	SARA 302 TPQ		SARA 304 RQ	
			(lbs)	(gallons)	(lbs)	(gallons)
Sulphuric acid	≤0.1	Yes.	1000	66.3	1000	66.3

Section 15. Regulatory information

SARA 304 RQ : 1111111.1 lbs / 504444.4 kg [133260.1 gal / 504444.4 L]

SARA 311/312

Classification : EYE IRRITATION - Category 2A

Composition/information on ingredients

Name	%	Classification
Siloxanes and Silicones, di-Me	≥10 - <25	EYE IRRITATION - Category 2A

State regulations

Massachusetts : None of the components are listed.

New York : None of the components are listed.

New Jersey : None of the components are listed.

Pennsylvania : None of the components are listed.

California Prop. 65

 **WARNING:** This product can expose you to Strong inorganic acid mists containing sulfuric acid, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Ingredient name	No significant risk level	Maximum acceptable dosage level
Strong inorganic acid mists containing sulfuric acid	-	-

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : All components are listed or exempted.

Canada : All components are listed or exempted.

China : All components are listed or exempted.

Eurasian Economic Union :  **Russian Federation inventory:** All components are listed or exempted.

Japan : **Japan inventory (CSCL):** All components are listed or exempted.

Japan inventory (ISHL): All components are listed or exempted.

New Zealand : All components are listed or exempted.

Philippines : All components are listed or exempted.

Republic of Korea : All components are listed or exempted.

Taiwan : All components are listed or exempted.

Thailand : Not determined.

Turkey : Not determined.

United States : All components are active or exempted.

Section 15. Regulatory information

Viet Nam : All components are listed or exempted.

Section 16. Other information

Procedure used to derive the classification

Classification	Justification
EYE IRRITATION - Category 2A	Calculation method

History

Date of issue : 05/19/2023
Date of previous issue : 05/20/2020
Version : 6
Key to abbreviations : ATE = Acute Toxicity Estimate
 BCF = Bioconcentration Factor
 GHS = Globally Harmonized System of Classification and Labelling of Chemicals
 IATA = International Air Transport Association
 IBC = Intermediate Bulk Container
 IMDG = International Maritime Dangerous Goods
 LogPow = logarithm of the octanol/water partition coefficient
 MARPOL = International Convention for the Prevention of Pollution From Ships, 1973
 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
 N/A = Not available
 UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

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SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Trade name

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Material number: 250014

Chemical nature:

Mixture of quaternary amines and ethoxylated imidazolines in water.

1.2. Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses of the substance or mixture

Industry sector : Oilfield

Type of use : Corrosion inhibitor

Exposure scenarios: see annex

1.3. Details of the supplier of the safety data sheet

Identification of the company

Clariant Gulf FZ-LLC

Dubai Science Park North Tower, Office No: 1601

Dubai – U.A.E

Information about the substance/mixture

BU Care Chemicals

Product Stewardship

e-mail: SDS.Europe@clariant.com

1.4. Emergency telephone number

00800-5121 5121 (24 h)

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification (REGULATION (EC) No 1272/2008)

Acute toxicity, Category 4

H302: Harmful if swallowed.

Skin irritation, Category 2

H315: Causes skin irritation.

Serious eye damage, Category 1

H318: Causes serious eye damage.

Skin sensitisation, Category 1

H317: May cause an allergic skin reaction.

Long-term (chronic) aquatic hazard,
Category 2

H411: Toxic to aquatic life with long lasting effects.

2.2 Label elements

Labelling (REGULATION (EC) No 1272/2008)

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Hazard pictograms	:	
Signal word	:	Danger
Hazard statements	:	H302 Harmful if swallowed. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H318 Causes serious eye damage. H411 Toxic to aquatic life with long lasting effects.
Precautionary statements	:	Prevention: P261 Avoid breathing mist or vapours. P264 Wash skin thoroughly after handling. P273 Avoid release to the environment. P280 Wear protective gloves/ eye protection/ face protection. Response: P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor. P391 Collect spillage.

Hazardous components which must be listed on the label:

Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide
Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Alkylpyridine benzyl chloride quaternary
Mercaptoacetic acid

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Ecological information: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Toxicological information: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

No additional hazards are known except those derived from the labelling.

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Components

Chemical name	CAS-No. EC-No.	Classification	Concentration (% w/w)
---------------	-------------------	----------------	--------------------------

SAFETY DATA SHEET
according to Regulation (EC) No. 1907/2006

CLARIANT 

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	Index-No. Registration number		
Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide	283149-88-2	Acute Tox. 4; H302 Skin Irrit. 2; H315 Eye Dam. 1; H318 Aquatic Chronic 1; H410 Aquatic Acute 1; H400	>= 3 - < 10
Ethanediol	107-21-1 203-473-3 603-027-00-1 01-2119456816-28 01-2119456816-28-0000 01-2119456816-28-0003 01-2119456816-28-0038 01-2119456816-28-0117 UK-20-5549617523-7-0000 UK-20-7511478711-4-0000 UK-20-8044687532-2-0000	Acute Tox. 4; H302 STOT RE 2; H373 (Kidney)	>= 1 - < 10
Fatty acids, tall-oil, reaction products with polyethylenepolyamines	68910-93-0 272-756-1	Skin Irrit. 2; H315 Eye Dam. 1; H318 Aquatic Chronic 1; H410 Aquatic Acute 1; H400	>= 3 - < 10
Alkylpyridine benzyl chloride quaternary	100765-57-9	Acute Tox. 4; H302 Acute Tox. 3; H331 Acute Tox. 3; H311 Skin Irrit. 2; H315 Eye Dam. 1; H318 Skin Sens. 1B; H317 STOT SE 3; H335 (Respiratory system) STOT RE 2; H373 Aquatic Chronic 2; H411	>= 3 - < 10
Mercaptoacetic acid	68-11-1 200-677-4 607-090-00-6 01-2119494933-24 DUIN-UK-20-1442979995-1-0000	Acute Tox. 3; H301 Acute Tox. 3; H331 Acute Tox. 3; H311 Skin Corr. 1B; H314 Eye Dam. 1; H318 Acute toxicity estimate Acute oral toxicity: 73	>= 1 - < 3

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		mg/kg Acute dermal toxicity: 848 mg/kg	
Methanol	67-56-1 200-659-6 603-001-00-X 01-2119433307-44 01-2119433307-44-0000 01-2119433307-44-0024 01-2119433307-44-0061 01-2119433307-44-0066 01-2119433307-44-0071 01-2119433307-44-0091 01-2119433307-44-0128 01-2119433307-44-0142 01-2119433307-44-0176 01-2119433307-44-XXXX	Flam. Liq. 2; H225 Acute Tox. 3; H301 Acute Tox. 3; H331 Acute Tox. 3; H311 STOT SE 1; H370 (Eyes, Central nervous system) specific concentration limit STOT SE 1; H370 ≥ 10 % STOT SE 2; H371 3 - < 10 % STOT SE 1; H370 ≥ 10 % STOT SE 2; H371 3 - < 10 %	≥ 1 - < 3

For explanation of abbreviations see section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

- General advice : Remove/ Take off immediately all contaminated clothing.
Get medical advice/ attention if you feel unwell.
- If inhaled : If inhaled, remove to fresh air.
Get medical advice/ attention.
- In case of skin contact : Wash off immediately with plenty of water.
Consult a physician.
- In case of eye contact : Rinse immediately with plenty of water, also under the eyelids,
for at least 15 minutes.
Consult a physician.
- If swallowed : Rinse mouth with water.
If conscious, give the victim plenty of water to drink.
Do NOT induce vomiting.
In case of unconsciousness do not induce vomiting or give anything by mouth.
Take victim immediately to hospital.

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4.2 Most important symptoms and effects, both acute and delayed

- Symptoms : irritant effects
corrosive effects
sensitising effects
- Risks : Causes skin irritation.
Causes serious eye damage.
May cause an allergic skin reaction.

4.3 Indication of any immediate medical attention and special treatment needed

- Treatment : Treat symptomatically.

SECTION 5: Firefighting measures

5.1 Extinguishing media

- Suitable extinguishing media : Dry powder
Alcohol-resistant foam
Carbon dioxide (CO₂)

5.2 Special hazards arising from the substance or mixture

- Specific hazards during firefighting : Carbon oxides
Sulphur oxides
Hydrogen sulfide (H₂S)

5.3 Advice for firefighters

- Special protective equipment for firefighters : Full protective suit In case of fire: Wear respiratory protection.
- Further information : Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

- Personal precautions : Ensure adequate ventilation.
Wear suitable protective equipment.
Wear respiratory protection.
Do not let the liquid drain into rivers, ponds or sewer systems.

6.2 Environmental precautions

- Environmental precautions : The product should not be allowed to enter drains, water courses or the soil.
If the product contaminates rivers and lakes or drains inform respective authorities.

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6.3 Methods and material for containment and cleaning up

Methods for cleaning up : Soak up with inert absorbent material.
Dispose of absorbed material in accordance with the regulations.
Rinse away rest with plenty of water

6.4 Reference to other sections

Information regarding Safe handling, see chapter 7., For personal protection see section 8., For disposal considerations see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling : Avoid spilling, spraying or splashing
Provide adequate ventilation.
In case of insufficient ventilation, wear suitable respiratory equipment.
Have eyewash bottle in readiness.

Advice on protection against fire and explosion : Observe the general rules of industrial fire protection

Hygiene measures : Do not eat, drink or smoke when using this product. Wash hands before breaks and at the end of workday. Take off immediately all contaminated clothing.

7.2 Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers : Keep container tightly closed in a cool, well-ventilated place.
Keep only in the original container.

Further information on storage conditions : Keep containers tightly closed in a cool, well-ventilated place.
Handle and open container with care.

7.3 Specific end use(s)

Specific use(s) : No further recommendations.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006:

Substance name	End Use	Exposure routes	Potential health effects	Value
Ethenediol CAS-No.: 107-21-1	Workers	Inhalation	Long-term local effects	35 mg/m3
Remarks:DNEL				

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	Workers	Dermal	Long-term systemic effects	106 mg/kg bw/day
	Remarks:DNEL			
	Consumers	Inhalation	Long-term local effects	7 mg/m3
	Remarks:DNEL			
	Consumers	Dermal	Long-term systemic effects	53 mg/kg bw/day
	Remarks:DNEL			
Mercaptoacetic acid CAS-No.: 68-11-1	Workers	Inhalation	Long-term systemic effects	1,13 mg/m3
	Remarks:DNEL			
	Workers	Inhalation	Acute systemic effects	4,5 mg/m3
	Remarks:DNEL			
	Workers	Inhalation	Acute local effects	4,5 mg/m3
	Remarks:DNEL			
	Workers	Dermal	Long-term systemic effects	1,6 mg/kg bw/day
	Remarks:DNEL			
	Consumers	Oral	Long-term systemic effects	0,08 mg/kg bw/day
	Remarks:DNEL			
Methanol CAS-No.: 67-56-1	Workers	Inhalation	Long-term systemic effects	130 mg/m3
	Remarks:DNEL			
	Workers	Inhalation	Acute systemic effects	130 mg/m3
	Remarks:DNEL			
	Workers	Inhalation	Long-term local effects	130 mg/m3
	Remarks:DNEL			
	Workers	Inhalation	Acute local effects	130 mg/m3
	Remarks:DNEL			
	Workers	Dermal	Long-term systemic effects	20 mg/kg bw/day
	Remarks:DNEL			
	Workers	Dermal	Acute systemic effects	20 mg/kg bw/day
	Remarks:DNEL			
	Consumers	Inhalation	Long-term systemic effects	26 mg/m3
	Remarks:DNEL			
	Consumers	Inhalation	Acute systemic effects	26 mg/m3
	Remarks:DNEL			
	Consumers	Inhalation	Long-term local effects	26 mg/m3
	Remarks:DNEL			
	Consumers	Inhalation	Acute local effects	26 mg/m3
	Remarks:DNEL			
	Consumers	Dermal	Long-term systemic effects	4 mg/kg bw/day

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	Remarks:DNEL			
	Consumers	Dermal	Acute systemic effects	4 mg/kg bw/day
	Remarks:DNEL			
	Consumers	Oral	Long-term systemic effects	4 mg/kg bw/day
	Remarks:DNEL			
	Consumers	Oral	Acute systemic effects	4 mg/kg bw/day
	Remarks:DNEL			

Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006:

Substance name	Environmental Compartment	Value
Mercaptoacetic acid CAS-No.: 68-11-1	Fresh water	0,027 mg/l
	Intermittent use/release	0,27 mg/l
	Marine water	0,003 mg/l
	Sewage treatment plant	0,5 mg/l
	Fresh water sediment	0,009 mg/kg dry weight (d.w.)
	Marine sediment	0,001 mg/kg dry weight (d.w.)
	Soil	0,005 mg/kg dry weight (d.w.)

8.2 Exposure controls

Engineering measures

Provide adequate ventilation.

Personal protective equipment

Eye/face protection : Tightly fitting safety goggles
Face-shield

Hand protection

Remarks : Neoprene gloves Nitrile rubber gloves. PVC or PE gloves

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : Use only in well-ventilated areas.
In the case of vapour formation use a respirator with an approved filter.
Equipment should conform to EN 14387
If the occupational exposure limits cannot be met, in exceptional cases suitable respiratory equipment should be worn only for a short period of time.
ABEK-P3-filter

Protective measures : Do not inhale vapours
Avoid contact with skin and eyes.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

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Physical state	: Liquid
Colour	: yellow to amber
Odour	: pungent
Odour Threshold	: not determined
Melting point	: < 0 °C
Boiling point	: > 100 °C
Upper explosion limit / upper flammability limit	: Not applicable
Lower explosion limit / Lower flammability limit	: Not applicable
Flash point	: > 61 °C
Auto-ignition temperature	: not available
Decomposition temperature	: > 100 °C
pH	: 5,17 (25 °C) Concentration: 100 %
Viscosity	
Viscosity, dynamic	: ca. 3,3 mPa.s (23 °C)
Viscosity, kinematic	: no data available
Solubility(ies)	
Water solubility	: soluble
Partition coefficient: n-octanol/water	: Not applicable
Vapour pressure	: approx. 3 kPa (20 °C)
Density	: ca. 1,02 g/cm ³ (25 °C)
Relative vapour density	: no data available
Particle characteristics	
Particle size	: Not applicable

9.2 Other information

Self-ignition	: no data available
Metal corrosion rate	: Not applicable

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Evaporation rate : Not applicable

SECTION 10: Stability and reactivity

10.1 Reactivity

See section 10.3. "Possibility of hazardous reactions"

10.2 Chemical stability

Stable under normal conditions.

10.3 Possibility of hazardous reactions

Hazardous reactions : With acids hydrogen sulphide is produced.

10.4 Conditions to avoid

Conditions to avoid : Keep away from heat.
Keep away from flames and sparks.

10.5 Incompatible materials

Materials to avoid : not known

10.6 Hazardous decomposition products

Carbon oxides
Sulphur oxides
Hydrogen sulfide (H₂S)

SECTION 11: Toxicological information

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity

Product:

Acute oral toxicity : Acute toxicity estimate: 1.351 mg/kg
Method: Calculation method

Acute inhalation toxicity : Acute toxicity estimate: > 20 mg/l
Exposure time: 4 h
Test atmosphere: vapour
Method: Calculation method

Acute dermal toxicity : Acute toxicity estimate: > 2.000 mg/kg
Method: Calculation method

Components:

Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide:

Acute oral toxicity : Assessment: The component/mixture is moderately toxic after single ingestion.

Ethanediol:

Acute oral toxicity : LD50 (Rat, male and female): Method: Other

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GLP: no

Assessment: The component/mixture is moderately toxic after single ingestion.

Acute inhalation toxicity : LC50 (Rat, male and female): > 2,5 mg/l
Exposure time: 6 h
Test atmosphere: dust/mist
Method: Other
GLP: yes
Assessment: The substance or mixture has no acute inhalation toxicity

Acute dermal toxicity : LD50 (Mouse, male and female): > 3.500 mg/kg
Method: Other
GLP: yes
Assessment: The substance or mixture has no acute dermal toxicity

Alkylpyridine benzyl chloride quaternary:

Acute oral toxicity : Assessment: The component/mixture is moderately toxic after single ingestion.

Acute inhalation toxicity : Assessment: The component/mixture is toxic after short term inhalation.

Acute dermal toxicity : Assessment: The component/mixture is toxic after single contact with skin.

Mercaptoacetic acid:

Acute oral toxicity : LD50 (Rat, male and female): 73 mg/kg
Method: OECD Test Guideline 401

Acute inhalation toxicity : Assessment: The component/mixture is toxic after short term inhalation.

Acute dermal toxicity : LD50 (Rabbit, male and female): 848 mg/kg
Method: OECD Test Guideline 402
GLP: no

Methanol:

Acute oral toxicity : LD50 (Rat, male and female): 1.187 - 2.769 mg/kg
Method: Other
GLP: no
Assessment: The component/mixture is toxic after single ingestion.

Acute inhalation toxicity : LC50 (Rat, male and female): 87,5 mg/l
Exposure time: 6 h
Test atmosphere: vapour
Method: Other
GLP: no
Assessment: The component/mixture is toxic after short term

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inhalation.

Acute dermal toxicity : Assessment: The component/mixture is toxic after single contact with skin.

Skin corrosion/irritation

Product:

Remarks : no data available

Components:

Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide:

Result : Irritating to skin.

Ethanediol:

Species : Rabbit
Exposure time : 20 h
Method : Other
Result : No skin irritation
GLP : no

Fatty acids, tall-oil, reaction products with polyethylenepolyamines:

Result : Irritating to skin.

Alkylpyridine benzyl chloride quaternary:

Result : Irritating to skin.

Mercaptoacetic acid:

Method : Other
Result : Causes burns.
GLP : yes

Methanol:

Species : Rabbit
Exposure time : <= 20 h
Method : Other
Result : No skin irritation
GLP : no

Serious eye damage/eye irritation

Product:

Remarks : no data available

Components:

Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide:

Result : Risk of serious damage to eyes.

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Ethanediol:

Species : Rabbit
Exposure time : 24 h
Method : Other
Result : No eye irritation
GLP : no

Fatty acids, tall-oil, reaction products with polyethylenepolyamines:

Result : Risk of serious damage to eyes.

Alkylpyridine benzyl chloride quaternary:

Result : Risk of serious damage to eyes.

Mercaptoacetic acid:

Species : Rabbit
Method : Directive 67/548/EEC, Annex V, B.5.
Result : Risk of serious damage to eyes.

Methanol:

Species : Rabbit
Method : Other
Result : No eye irritation
GLP : no

Respiratory or skin sensitisation

Product:

Remarks : no data available

Components:

Ethanediol:

Test Type : Maximisation Test
Exposure routes : Dermal
Species : Guinea pig
Method : OECD Test Guideline 406
Result : Not a skin sensitizer.
GLP : yes

Assessment : Harmful if swallowed.

Alkylpyridine benzyl chloride quaternary:

Result : The product is a skin sensitizer, sub-category 1B.

Mercaptoacetic acid:

Remarks : no data available

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Methanol:

Test Type : Maximisation Test
Exposure routes : Dermal
Species : Guinea pig
Method : OECD Test Guideline 406
Result : Not a skin sensitizer.
GLP : no

Assessment : Toxic if swallowed, in contact with skin or if inhaled.

Germ cell mutagenicity

Product:

Germ cell mutagenicity-
Assessment : No information available.

Components:

Ethanediol:

Genotoxicity in vitro : Test Type: Ames test
Test system: Salmonella typhimurium
Concentration: 33 - 5000 µg/plate
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
GLP: yes

Test Type: Ames test
Test system: Escherichia coli
Concentration: 33 - 5000 µg/plate
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
GLP: yes

Test Type: Chromosome aberration test in vitro
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: Other
Result: negative
GLP: yes

Test Type: In vitro mammalian cell gene mutation test
Test system: mouse lymphoma cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 476
Result: negative
GLP: yes

Genotoxicity in vivo : Test Type: Dominant lethal assay
Species: Rat (male and female)

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Strain: Fischer F344
Application Route: oral (feed)
Exposure time: 3 generation
Dose: 40 - 200 - 1000 mg/kg
Method: Other
Result: negative
GLP: no

Germ cell mutagenicity-
Assessment : It is concluded that the product is not mutagenic based on
evaluation of several mutagenicity tests.

Mercaptoacetic acid:

Genotoxicity in vitro : Test Type: In vitro gene mutation study in bacteria
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative

Test Type: In vitro gene mutation study in mammalian cells
Test system: mouse lymphoma cells
Metabolic activation: with and without metabolic activation
Method: Regulation (EC) No. 440/2008, Annex, B.17
Result: negative
GLP: yes
Remarks: By analogy with a product of similar composition

Test Type: Chromosome aberration test in vitro
Test system: Human lymphocytes
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative
GLP: yes

Genotoxicity in vivo : Test Type: Micronucleus test
Species: Mouse (male)
Strain: Switzerland
Application Route: Dermal
Dose: 1000, 500, 250 mg/kg
Method: OECD Test Guideline 474
Result: negative
GLP: yes

Test Type: Micronucleus test
Species: Mouse (female)
Strain: Switzerland
Application Route: Dermal
Dose: 500, 250, 125 mg/kg
Method: OECD Test Guideline 474
Result: negative
GLP: yes

Germ cell mutagenicity-
Assessment : In vitro tests did not show mutagenic effects, In vivo tests did
not show mutagenic effects

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Methanol:

- Genotoxicity in vitro : Test Type: Micronucleus test
Test system: Chinese hamster lung cells
Concentration: 40 mg/ml
Method: Other
Result: negative
GLP: No information available.
- Test Type: HGPRT assay
Test system: Chinese hamster lung cells
Concentration: 15,8 - 63,3 mg/ml
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 476
Result: negative
GLP: No information available.
- Test Type: In vitro gene mutation study in bacteria
Test system: Salmonella typhimurium
Concentration: 5 - 5000 µg/plate
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative
GLP: No information available.
- Genotoxicity in vivo : Test Type: Chromosome Aberration Test
Species: Mouse (male)
Strain: C57BL/6 x DBA/2
Application Route: Inhalation
Exposure time: 5 d, 6 h/day
Dose: 1,04 - 5,3 mg/l
Method: Other
Result: negative
GLP: No information available.
- Germ cell mutagenicity-
Assessment : It is concluded that the product is not mutagenic based on
evaluation of several mutagenicity tests.

Carcinogenicity

Product:

- Carcinogenicity -
Assessment : No information available.

Components:

Ethanediol:

- Species : Mouse, male and female
Application Route : oral (feed)
Exposure time : 2 a
Dose : 6250-12500-25000-50000 ppm
Control Group : yes
Frequency of Treatment : daily

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NOAEL : 1.500 mg/kg bw/day
Method : Other
GLP : yes

Carcinogenicity -
Assessment : Not classifiable as a human carcinogen.

Mercaptoacetic acid:

Species : Mouse, female
Application Route : Dermal
Dose : 1% and 2% in acetone
Method : Other
Result : negative
GLP : no
Remarks : By analogy with a product of similar composition

Carcinogenicity -
Assessment : Not classifiable as a human carcinogen.

Methanol:

Species : Rat, male and female
Application Route : Inhalation
Exposure time : 24
Dose : 0,013 - 0,13 - 1,3 mg/l
Control Group : yes
Frequency of Treatment : 20 h/day
NOAEL : >= 1,3 mg/l
Method : OECD Test Guideline 453
GLP : No information available.

Carcinogenicity -
Assessment : Not classifiable as a human carcinogen.

Reproductive toxicity

Product:

Reproductive toxicity -
Assessment : No information available.
No information available.

Components:

Ethanediol:

Effects on fertility : Test Type: Three-generation study
Species: Rat, male and female
Strain: Fischer F344
Application Route: oral (feed)
Dose: 40 - 200 - 1000
General Toxicity - Parent: NOAEL: > 1.000 mg/kg body weight
General Toxicity F1: NOAEL: > 1.000 mg/kg body weight
General Toxicity F2: NOAEL: > 1.000 mg/kg body weight
Method: Other
GLP: no

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Effects on foetal development : Test Type: reproductive and developmental toxicity study
Species: Rat, female
Strain: Sprague-Dawley
Application Route: oral (gavage)
Dose: 150 - 500 - 1000 - 2500 mg/kg
Duration of Single Treatment: 9 d
General Toxicity Maternal: NOEL: 1.500 mg/kg body weight
Teratogenicity: NOEL: 150 mg/kg body weight
Method: Other
GLP: yes

Reproductive toxicity - Assessment : No reproductive toxicity to be expected.
No teratogenic effects to be expected.

Mercaptoacetic acid:

Effects on fertility : Test Type: One generation study
Species: Rat, male and female
Strain: Sprague-Dawley
Application Route: oral (gavage)
Dose: 0, 20, 40 or 80 mg/kg/day
General Toxicity - Parent: NOEL: 20 mg/kg body weight
General Toxicity F1: NOEL: 40 mg/kg body weight
Method: OECD Test Guideline 421
GLP: yes
Remarks: By analogy with a product of similar composition

Effects on foetal development : Test Type: Pre-natal
Species: Rat
Strain: wistar
Application Route: oral (gavage)
Dose: 3, 15 and 75 mg/kg
General Toxicity Maternal: NOAEL: 15 mg/kg body weight
Developmental Toxicity: NOAEL: 75 mg/kg body weight
Method: OECD Test Guideline 414
GLP: yes
Remarks: By analogy with a product of similar composition

Test Type: Pre-natal
Species: Rat
Strain: Sprague-Dawley
Application Route: Dermal
Dose: 50, 100 or 200 mg/day
General Toxicity Maternal: NOAEL: < 50 mg/kg body weight
Developmental Toxicity: NOAEL: >= 100 mg/kg body weight
Method: OECD Test Guideline 414
GLP: yes
Remarks: By analogy with a product of similar composition

Test Type: Pre-natal
Species: Rabbit
Strain: New Zealand white
Application Route: Dermal

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Dose: 10, 15, 25 or 65 mg/kg/day
General Toxicity Maternal: NOAEL: $\geq$ 65 mg/kg body weight
Developmental Toxicity: NOAEL: $\geq$ 65 mg/kg body weight
Method: OECD Test Guideline 414
GLP: yes
Remarks: By analogy with a product of similar composition

Reproductive toxicity - Assessment : Weight of evidence does not support classification for reproductive toxicity

Methanol:

Effects on fertility : Test Type: Two-generation study
Species: Rat, male and female
Strain: Sprague-Dawley
Application Route: Inhalation
Dose: 0,013 - 0,13 - 1,3 mg/l
Duration of Single Treatment: 20 h
General Toxicity - Parent: NOAEC: 1,3 mg/l
General Toxicity F1: NOAEC: 0,13 mg/l
General Toxicity F2: NOAEC: 0,13 mg/l
Method: OECD Test Guideline 416
GLP: No information available.

Effects on foetal development : Test Type: Pre-natal
Species: Rat, female
Strain: Sprague-Dawley
Application Route: Inhalation
Dose: 0,27 - 1,33 - 6,65 mg/l
Duration of Single Treatment: 22,7 h
General Toxicity Maternal: NOAEC: 1,33 mg/l
Teratogenicity: NOAEC F1: 1,33 mg/l
Method: OECD Test Guideline 414
GLP: No information available.

Test Type: Pre-natal
Species: Rat
Strain: Long-Evans
Application Route: oral (gavage)
Dose: 1027 - 2054 - 4108 mg/kg
Frequency of Treatment: 1
General Toxicity Maternal: LOAEL: 1.027 mg/kg body weight
Teratogenicity: LOAEL F1: 1.027 mg/kg body weight
Method: OECD Test Guideline 414
GLP: No information available.

Reproductive toxicity - Assessment : No reproductive toxicity to be expected.
No teratogenic effects to be expected.

STOT - single exposure

Product:

Remarks : no data available

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Components:

Ethanediol:

Assessment : The substance or mixture is not classified as specific target organ toxicant, single exposure.

Alkylpyridine benzyl chloride quaternary:

Assessment : May cause respiratory irritation.

Mercaptoacetic acid:

Assessment : The substance or mixture is not classified as specific target organ toxicant, single exposure.

Methanol:

Target Organs : Eyes, Central nervous system
Assessment : Causes damage to organs.

STOT - repeated exposure

Product:

Remarks : no data available

Components:

Ethanediol:

Exposure routes : Oral
Target Organs : Kidney
Assessment : May cause damage to organs through prolonged or repeated exposure.

Alkylpyridine benzyl chloride quaternary:

Assessment : May cause damage to organs through prolonged or repeated exposure.

Mercaptoacetic acid:

Assessment : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Methanol:

Assessment : The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Repeated dose toxicity

Product:

Remarks : no data available

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Components:

Ethanediol:

Species : Rat, male
NOAEL : 150 mg/kg bw/day
Application Route : oral (feed)
Exposure time : 16 w
Number of exposures : daily
Dose : 50 - 150 - 500 - 1000 mg/kg
Control Group : yes
Method : OECD Test Guideline 408
GLP : No information available.

Species : Dog, male
NOAEL : 2.200 - 4.400 mg/kg bw/day
Application Route : Dermal
Exposure time : 4 w
Number of exposures : daily
Dose : 2 - 4 mL/kg bw
Control Group : yes
Method : OECD Test Guideline 410
GLP : yes

Species : Rat, male and female
NOAEL : 200 mg/kg bw/day
Application Route : oral (gavage)
Exposure time : 33 d
Number of exposures : daily
Dose : 220, 660, 2000 mg/kg bw/day
Control Group : yes
Method : OECD Test Guideline 407

Species : Rat, male
NOAEL : 150 mg/kg bw/day
Application Route : oral (feed)
Exposure time : 12 months
Number of exposures : daily
Dose : 50, 150, 300, 400 mg/kg bw/day
Control Group : yes
Method : OECD Test Guideline 452

Mercaptoacetic acid:

Species : Rat, male and female
NOEL : 7 mg/kg
NOAEL : 20 mg/kg
LOAEL : 60 mg/kg
Application Route : oral (gavage)
Exposure time : 13 weeks
Number of exposures : 7 days/week
Dose : 7, 20, 60 mg/kg bw/d
Method : OECD Test Guideline 408
GLP : yes
Remarks : By analogy with a product of similar composition

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Species : Rat, male and female
NOAEL : ≥ 180 mg/kg
LOAEL : 11,25 mg/kg
Application Route : Dermal
Exposure time : 13 weeks
Number of exposures : 5 times/week
Dose : 11.25,22.5,45,90,180mg/kg bw/d
Method : OECD Test Guideline 411
Remarks : By analogy with a product of similar composition

Methanol:

Species : Monkey, male
LOAEL : 2.340 mg/kg
Application Route : oral (gavage)
Exposure time : 3 d
Number of exposures : daily
Dose : 2340 mg/kg
Control Group : no data available
Method : Other
GLP : No information available.
Remarks : Significant toxicity observed in testing

Species : Rat, male and female
NOEL : 0,13 mg/l
LOAEL : 1,3 mg/l
Application Route : Inhalation
Test atmosphere : vapour
Exposure time : 12 m
Number of exposures : 20 h/day
Dose : 0,013 - 0,13 - 1,3 mg/l
Control Group : yes
Method : OECD Test Guideline 453
GLP : No information available.

Species : Rat, male and female
NOAEL : 6,66 mg/l
Application Route : Inhalation
Test atmosphere : vapour
Exposure time : 4 w
Number of exposures : 6 h/d, 5 d/wk
Dose : 0,663 - 2,65 - 6,63 mg/l
Control Group : yes
Method : OECD Test Guideline 412
GLP : No information available.

Application Route : Skin contact
Remarks : not tested.

Aspiration toxicity

Product:

no data available

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Components:

Ethanediol:

No aspiration toxicity classification

Mercaptoacetic acid:

No aspiration toxicity classification

Methanol:

No aspiration toxicity classification

11.2 Information on other hazards

Endocrine disrupting properties

Product:

Assessment : The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

SECTION 12: Ecological information

12.1 Toxicity

Product:

Toxicity to fish : Remarks: no data available

Toxicity to daphnia and other aquatic invertebrates : Remarks: no data available

Toxicity to algae/aquatic plants : Remarks: no data available

Toxicity to microorganisms : Remarks: no data available

Components:

Reaction product of tallow fatty propylene diamine, formaldehyde and ethylene oxide:

Ecotoxicology Assessment

Acute aquatic toxicity : Very toxic to aquatic life.

Chronic aquatic toxicity : Very toxic to aquatic life with long lasting effects.

Ethanediol:

Toxicity to fish : LC50 (Pimephales promelas (fathead minnow)): 72.860 mg/l
Exposure time: 96 h
Test Type: static test
Analytical monitoring: yes

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Method: EPA

GLP: no

Remarks: The details of the toxic effect relate to the nominal concentration.

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): > 100 mg/l
Exposure time: 48 h

Test Type: static test

Analytical monitoring: yes

Method: OECD Test Guideline 202

GLP: yes

Toxicity to algae/aquatic plants : EC50 (Pseudokirchneriella subcapitata (green algae)): 6.500 - 13.000 mg/l

End point: Growth rate

Exposure time: 7 d

Test Type: static test

Analytical monitoring: no data available

Method: EPA

GLP: No information available.

Toxicity to microorganisms : EC20 (activated sludge, domestic): > 1.995 mg/l
End point: Bacteria toxicity (respiration inhibition)

Exposure time: 0,5 h

Analytical monitoring: no

Method: ISO 8192

GLP: no

Toxicity to fish (Chronic toxicity) : Chronic Toxicity Value: 2.629 mg/l
End point: Other

Exposure time: 30 d

Species: Fish

Method: Other

GLP: no

Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEC: 8.590 mg/l
End point: Reproduction rate
Exposure time: 7 d

Species: Ceriodaphnia spec.

Test Type: semi-static test

Analytical monitoring: yes

Method: Other

GLP: No information available.

Remarks: The details of the toxic effect relate to the nominal concentration.

Fatty acids, tall-oil, reaction products with polyethylenepolyamines:

Ecotoxicology Assessment

Acute aquatic toxicity : Very toxic to aquatic life.

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Chronic aquatic toxicity : Very toxic to aquatic life with long lasting effects.

Alkylpyridine benzyl chloride quaternary:

Ecotoxicology Assessment

Chronic aquatic toxicity : Toxic to aquatic life with long lasting effects.

Mercaptoacetic acid:

Toxicity to fish : LC50 (Oncorhynchus mykiss (rainbow trout)): > 100 mg/l

End point: mortality

Exposure time: 96 h

Test Type: flow-through test

Method: OECD Test Guideline 203

GLP: yes

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 38 mg/l

End point: Immobilization

Exposure time: 48 h

Test Type: static test

Method: OECD Test Guideline 202

GLP: yes

Toxicity to algae/aquatic plants : EC50 (Pseudokirchneriella subcapitata (algae)): 13 mg/l

End point: Biomass

Exposure time: 72 h

Test Type: static test

Method: OECD Test Guideline 201

GLP: yes

EC50 (Pseudokirchneriella subcapitata (algae)): 27 mg/l

End point: Growth rate

Exposure time: 72 h

Test Type: static test

Method: OECD Test Guideline 201

GLP: yes

Toxicity to microorganisms : EC50 (activated sludge): 530 mg/l

Exposure time: 3 h

Test Type: static test

Method: OECD Test Guideline 209

GLP: yes

Remarks: By analogy with a product of similar composition

NOEC (activated sludge): 32 mg/l

Exposure time: 3 h

Test Type: static test

Method: OECD Test Guideline 209

GLP: yes

Remarks: By analogy with a product of similar composition

Toxicity to fish (Chronic toxicity) : Remarks: no data available

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Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : Remarks: no data available

Methanol:

Toxicity to fish : LC50 (Lepomis macrochirus (Bluegill sunfish)): 15.400 mg/l
End point: mortality
Exposure time: 96 h
Test Type: flow-through test
Analytical monitoring: yes
Method: EPA
GLP: No information available.

Toxicity to daphnia and other aquatic invertebrates : EC50 (Daphnia magna (Water flea)): 18.260 mg/l
End point: Immobilization
Exposure time: 96 h
Test Type: semi-static test
Analytical monitoring: no data available
Method: OECD Test Guideline 202
GLP: No information available.
Remarks: The details of the toxic effect relate to the nominal concentration.

Toxicity to algae/aquatic plants : ErC50 (Pseudokirchneriella subcapitata (microalgae)): ca. 22.000 mg/l
End point: Growth rate
Exposure time: 96 h
Test Type: static test
Analytical monitoring: no data available
Method: OECD Test Guideline 201
GLP: No information available.

Toxicity to microorganisms : IC50 (activated sludge): > 1.000 mg/l
End point: Bacteria toxicity (growth inhibition)
Exposure time: 3 h
Test Type: aquatic
Analytical monitoring: yes
Method: OECD Test Guideline 209
GLP: No information available.

Toxicity to fish (Chronic toxicity) : NOEC: 446,7 mg/l
Exposure time: 28 d
Species: Pimephales promelas (fathead minnow)
Method: Other
GLP: no
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity) : NOEC: 208 mg/l
End point: Reproduction rate
Exposure time: 21 d
Species: Daphnia magna (Water flea)

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Method: calculated
GLP: no
Remarks: The value is given based on a SAR/AAR approach using OECD Toolbox, DEREK, VEGA QSAR models (CAESAR models), etc.

Toxicity to soil dwelling organisms : LC50: > 1 mg/cm²
Exposure time: 48 h
End point: mortality
Species: Eisenia fetida (earthworms)
Method: OECD Test Guideline 207
GLP: No information available.

NOEC:
10000 mg/kg dry weight (d.w.)
Exposure time: 28 d
End point: mortality
Species: Folsomia candida
Method: Other
GLP: No information available.

Plant toxicity : IC50: ca. 41.000 mg/l
Exposure time: 3 d
End point: emergence
Species: Lactuca sativa (lettuce)
Analytical monitoring: no data available
Method: Other
GLP: no

Sediment toxicity : Remarks: Not applicable

12.2 Persistence and degradability

Product:

Biodegradability : Biodegradation: < 20 %
Method: OECD

Components:

Ethanediol:

Biodegradability : Test Type: aerobic
Inoculum: activated sludge
Concentration: 53 mg/l
Result: Readily biodegradable.
Biodegradation: 90 - 100 %
Related to: Dissolved organic carbon (DOC)
Exposure time: 10 d
Method: OECD Test Guideline 301A
GLP: yes

Mercaptoacetic acid:

Biodegradability : Test Type: aerobic
Inoculum: activated sludge

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Result: Readily biodegradable.
Biodegradation: 67 %
Exposure time: 28 d
Method: OECD Test Guideline 301D

Methanol:

Biodegradability : Test Type: aerobic
Inoculum: activated sludge
Concentration: 3 - 10 mg/l
Result: Readily biodegradable.
Biodegradation: 95 %
Related to: Biochemical Oxygen Demand (BOD)
Exposure time: 20 d
Method: Closed Bottle test
GLP: no

Test Type: aerobic
Inoculum: activated sludge
Concentration: 4 - 200 g/l
Result: Readily biodegradable.
Biodegradation: 82,7 %
Related to: Biochemical Oxygen Demand (BOD)
Exposure time: 5 d
Method: Other
GLP: no

Photodegradation : Rate constant: 9,32E-13 cm³/s
Degradation (indirect photolysis): 50 % Degradation half life:
17,2 d
GLP: no

12.3 Bioaccumulative potential

Product:

Bioaccumulation : Remarks: no data available

Components:

Ethanediol:

Bioaccumulation : Remarks: Due to the low logPow bioaccumulation is not expected

Partition coefficient: n-octanol/water : log Pow: -1,36
Method: estimated
GLP: no

Mercaptoacetic acid:

Bioaccumulation : Remarks: No bioaccumulation is to be expected (log Pow <= 4).

Partition coefficient: n-octanol/water : log Pow: -2,99 (22 °C)
pH: 7

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Method: OECD Test Guideline 107

Methanol:

Bioaccumulation : Species: Leuciscus idus (Golden orfe)
Exposure time: 72 h
Bioconcentration factor (BCF): < 10
Method: Other
GLP: No information available.

Partition coefficient: n-octanol/water : log Pow: -0,77
Method: No information available.
GLP: No information available.

12.4 Mobility in soil

Product:

Distribution among environmental compartments : Remarks: no data available

Components:

Ethanediol:

Distribution among environmental compartments : Adsorption/Soil
Medium: water - soil
log Koc: 0
Method: other (calculated)

Methanol:

Distribution among environmental compartments : Adsorption/Soil
Medium: water - soil
Koc: 1
Method: other (calculated)

12.5 Results of PBT and vPvB assessment

Product:

Assessment : This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Components:

Ethanediol:

Assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT).

Methanol:

Assessment : This substance is not considered to be persistent, bioaccumulating and toxic (PBT).

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12.6 Endocrine disrupting properties

Product:

Assessment : The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects

Product:

Additional ecological information : no data available

Components:

Ethanediol:

Environmental fate and pathways : not available

Additional ecological information : Do not allow to enter ground water, waterways or waste water.

Methanol:

Environmental fate and pathways : not available

Additional ecological information : Do not allow to enter ground water, waterways or waste water.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product : Dispose of in accordance with local regulations.

Contaminated packaging : Packaging that cannot be cleaned should be disposed of as product waste

SECTION 14: Transport information

Section 14.1. to 14.5.

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ADR

UN no.	UN 1760
Proper shipping name:	Corrosive liquid, n.o.s.
Hazard inducer(s):	Thioglycolic acid Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Class:	8
Primary risk:	8
Packing group:	II
Hazard no. :	80
Environmental hazards:	Special marking provision: environmentally hazardous
Remarks	Shipment permitted

ADN

UN no.	UN 1760
Proper shipping name:	Corrosive liquid, n.o.s.
Hazard inducer(s):	Thioglycolic acid Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Class:	8
Primary risk:	8
Packing group:	II
Environmental hazards:	Special marking provision: environmentally hazardous
Remarks	Shipment permitted

RID

UN no.	UN 1760
Proper shipping name:	Corrosive liquid, n.o.s.
Hazard inducer(s):	Thioglycolic acid Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Class:	8
Primary risk:	8
Packing group:	II
Hazard no. :	80
Environmental hazards:	Special marking provision: environmentally hazardous
Remarks	Shipment permitted

IATA

UN no.	UN 1760
Proper shipping name:	Corrosive liquid, n.o.s.
Hazard inducer(s):	Thioglycolic acid Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Class:	8
Primary risk:	8
Packing group:	II
Environmental hazards:	Special marking provision: environmentally hazardous
Remarks	Shipment permitted

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IMDG

UN no.	UN 1760
Proper shipping name:	Corrosive liquid, n.o.s.
Hazard inducer(s):	Thioglycolic acid Fatty acids, tall-oil, reaction products with polyethylenepolyamines
Class:	8
Primary risk:	8
Packing group:	II
Environmental hazards:	Special marking provision: environmentally hazardous
Remarks	Shipment permitted
Marine pollutant:	Marine Pollutant
Hazard inducer/Marine pollutant:	Fatty acids, tall-oil, reaction products with polyethylenepolyamines
EmS :	F-A S-B

14.6. Special precautions for user

See sections 6 to 8 of this Safety Data Sheet.

14.7. Maritime transport in bulk according to IMO instruments

No transport as bulk according IBC - Code.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles (Annex XVII)	: Conditions of restriction for the following entries should be considered: Number on list 3 Methanol (Number on list 75, 69)
REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).	: Not applicable
Regulation (EC) No 1005/2009 on substances that deplete the ozone layer	: Not applicable
Regulation (EU) 2019/1021 on persistent organic pollutants (recast)	: Not applicable
Council Regulation (EC) No 111/2005 laying down rules for the monitoring of trade between the Community and third countries in drug precursors	: Neither banned nor restricted
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals	: Not applicable
REACH - List of substances subject to authorisation (Annex XIV)	: Not applicable

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Other regulations:

Apart from the data/regulations specified in this chapter, no further information is available concerning safety, health and environmental protection.

European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures.

15.2 Chemical safety assessment

Chemical Safety Assessments (CSAs) are available for one or more of the component substances contained in this product.

SECTION 16: Other information

Full text of H-Statements

H225	: Highly flammable liquid and vapour.
H301	: Toxic if swallowed.
H302	: Harmful if swallowed.
H311	: Toxic in contact with skin.
H314	: Causes severe skin burns and eye damage.
H315	: Causes skin irritation.
H317	: May cause an allergic skin reaction.
H318	: Causes serious eye damage.
H331	: Toxic if inhaled.
H335	: May cause respiratory irritation.
H370	: Causes damage to organs.
H373	: May cause damage to organs through prolonged or repeated exposure.
H373	: May cause damage to organs through prolonged or repeated exposure if swallowed.
H400	: Very toxic to aquatic life.
H410	: Very toxic to aquatic life with long lasting effects.
H411	: Toxic to aquatic life with long lasting effects.

Full text of other abbreviations

Acute Tox.	: Acute toxicity
Aquatic Acute	: Short-term (acute) aquatic hazard
Aquatic Chronic	: Long-term (chronic) aquatic hazard
Eye Dam.	: Serious eye damage
Flam. Liq.	: Flammable liquids
Skin Corr.	: Skin corrosion
Skin Irrit.	: Skin irritation
Skin Sens.	: Skin sensitisation
STOT RE	: Specific target organ toxicity - repeated exposure
STOT SE	: Specific target organ toxicity - single exposure

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN -

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Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - Substance of Very High Concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

Further information

Other information : Observe national and local legal requirements

Classification of the mixture:

Classification procedure:

Acute Tox. 4

H302

Calculation method

Skin Irrit. 2

H315

Calculation method

Eye Dam. 1

H318

Calculation method

Skin Sens. 1

H317

Calculation method

Aquatic Chronic 2

H411

Calculation method

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SAFETY DATA SHEET
according to Regulation (EC) No. 1907/2006



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information before handling any of these products. For additional information, please contact Clariant.

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Exposure scenario

Number	Title
ES 1	Formulation or re-packing; Formulation & (re)packing of substances and mixtures PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC15, PROC28 - ERC2 2-Butoxyethanol
ES 2	Widespread use by professional workers; Use in oil and gas field drilling and production operations, off-shore PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC28 - ERC8d 2-Butoxyethanol
ES 3	Widespread use by professional workers; Use in oil and gas field drilling and production operations, on-shore PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC28 - ERC8d 2-Butoxyethanol
ES 4	Use at industrial sites; Use in oil and gas field drilling and production operations, off-shore PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC28 - ERC4 2-Butoxyethanol
ES 5	Use at industrial sites; Use in oil and gas field drilling and production operations, on-shore PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC28 - ERC4 2-Butoxyethanol

1. ES 1: Formulation or re-packing; Formulation & (re)packing of substances and mixtures

1.1. Title section

Environment		
CS1:	Formulation or re-packing (Formulation into mixture)	ERC2
Workers		
CS2:	Formulation or re-packing (General measures applicable to all activities)	CS135
CS3:	Formulation or re-packing (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS4:	Formulation or re-packing (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2
CS5:	Formulation or re-packing (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure	PROC3

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	or processes with equivalent containment condition)	
CS6:	Formulation or re-packing (Chemical production where opportunity for exposure arises)	PROC4
CS7:	Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS8:	Formulation or re-packing (Mixing or blending in batch processes)	PROC5
CS9:	Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS10:	Formulation or re-packing (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS11:	Formulation or re-packing (Transfer of substance or mixture into small containers (dedicated filling line, including weighing))	PROC9
CS12:	Formulation or re-packing (Use as laboratory reagent)	PROC15

1.2. ES 1 Conditions of use affecting exposure

1.2.1 ES 1 - CS 1: Control of environmental exposure: Formulation or re-packing (Formulation into mixture) (ERC2)

Remarks : ESVOC SPERC 2.2.v1

Product characteristics

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Non-hydrophobic

Amount used

Annual amount per site : 8330 tonnes/year
Daily amount per site : 27800 kg/day
Daily amount per site (Msafe) : 185.000 kg

Environment factors not influenced by risk management

Dilution Factor (River) : 10
Dilution Factor (Coastal Areas) : 100

Other given operational conditions affecting environmental exposure

Number of emission days per year : 300
Remarks : Continuous process, Continuous release

Technical conditions and measures / Organizational measures

Water : Prevent discharge of undissolved substance to or recover from onsite wastewater.
Remarks : Bund storage facilities to prevent soil and water pollution in the event of spillage.
Prevent environmental discharge consistent with regulatory requirements.
A leak prevention plan is needed to prevent low level continual releases.
Site should have a spill plan to ensure that adequate safeguards are in place to minimize the impact of episodic

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releases.

Conditions and measures related to sewage treatment plant

Type of Sewage Treatment Plant : Sewage treatment plant
Flow rate of sewage treatment : 2.000 m3/d
plant effluent
Effectiveness (of a measure) : 87 %

Waste management measures

Disposal methods : Incineration (Effectiveness (of a measure): 99,98 %)
Waste treatment : This material and its container must be disposed of as hazardous., Dispose of waste product or used containers according to local regulations.

1.2.2 ES 1 - CS 2: Control of worker exposure: Formulation or re-packing (General measures applicable to all activities) (CS135)

Product characteristics

Concentration of the Substance in : <= 100 %
Mixture/Article

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Assumes use at not more than 20°C above ambient temperature.

Frequency and duration of use

Exposure duration : 8 h
Remarks : Continuous process

Other operational conditions affecting workers exposure

Remarks : Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure that direct skin contact is avoided.
Identify potential areas for indirect skin contact.
Clear spills immediately.
Wash off any skin contamination immediately.
Ensure operatives are trained to minimise exposures.
Avoid direct eye contact with product, also via contamination on hands.
Avoid splashing.

Technical conditions and measures : Formulate in enclosed or ventilated mixing vessels.

Personal protective measures : Use suitable eye protection.
For further specification, refer to section 8 of the SDS.

Personal protective measures : In case of potential exposure:
Wear suitable gloves tested to EN374.
For further specification, refer to section 8 of the SDS.

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1.2.3 ES 1 - CS 3: Control of worker exposure: Formulation or re-packing (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Remarks : General exposures
Closed systems
Continuous process
no sampling

Risk Management Measures

Note : No other specific measures identified.

1.2.4 ES 1 - CS 4: Control of worker exposure: Formulation or re-packing (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Remarks : General exposures
Closed systems
Continuous process
With sample collection
Bulk product storage

Risk Management Measures

Note : No other specific measures identified.

1.2.5 ES 1 - CS 5: Control of worker exposure: Formulation or re-packing (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Remarks : General exposures
Use in contained systems
Batch process
With sample collection
Process sampling

Risk Management Measures

Note : No other specific measures identified.

1.2.6 ES 1 - CS 6: Control of worker exposure: Formulation or re-packing (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : General exposures
Open systems

Risk Management Measures

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Note : No other specific measures identified.

1.2.7 ES 1 - CS 7: Control of worker exposure: Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Remarks : Bulk transfers
Drum/batch transfers

Risk Management Measures

Note : No other specific measures identified.

1.2.8 ES 1 - CS 8: Control of worker exposure: Formulation or re-packing (Mixing or blending in batch processes) (PROC5)

Remarks : Mixing operations
Open systems

Risk Management Measures

Note : No other specific measures identified.

1.2.9 ES 1 - CS 9: Control of worker exposure: Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers
Manual

Risk Management Measures

Note : No other specific measures identified.

1.2.10 ES 1 - CS 10: Control of worker exposure: Formulation or re-packing (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Note : No other specific measures identified.

1.2.11 ES 1 - CS 11: Control of worker exposure: Formulation or re-packing (Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC9)

Remarks : Drum and small package filling

Risk Management Measures

Note : No other specific measures identified.

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1.2.12 ES 1 - CS 12: Control of worker exposure: Formulation or re-packing (Use as laboratory reagent) (PROC15)

Remarks : Laboratory activities

Risk Management Measures

Note : No other specific measures identified.

1.3. ES 1 Exposure estimation and reference to its source

1.3.1 ES 1 - CS 1: Environmental release and exposure: Formulation or re-packing (Formulation into mixture) (ERC2)

Release route	Release rate	Release estimation method
Air	0,1 %	ESVOC SPERC 2.2.v1, (Initial release prior to RMM)
Water	0,5 %	ESVOC SPERC 2.2.v1, (Initial release prior to RMM)
Soil	0,01 %	ESVOC SPERC 2.2.v1, (Initial release prior to RMM)

protection target	Exposure estimation and reference to its source (ECETOC TRA)	RCR
Sewage treatment plant	69,5 mg/L (Risk from environmental exposure is driven by wastewater treatment plant microbes.)	0,15
Freshwater	0,885 mg/L	0,10
Freshwater sediment	3,77 mg/kg dry weight	0,11
Marine water	0,0886 mg/L	0,10
Marine sediment	0,377 mg/kg dry weight	0,11
Soil	0,150 mg/kg dry weight	0,06

1.3.3 ES 1 - CS 3: Worker exposure: Formulation or re-packing (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	0,01 ppm (ECETOC TRA worker v3, long-term)	< 0,01
inhalative	0,04 ppm (ECETOC TRA worker v3, short-term)	< 0,01
dermal	0,03 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.4 ES 1 - CS 4: Worker exposure: Formulation or re-packing (Chemical production or refinery in closed continuous process with occasional controlled exposure or

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processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1 ppm (ECETOC TRA worker v3, long-term)	0,05
inhalative	4 ppm (ECETOC TRA worker v3, short-term)	0,08
dermal	1,4 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.5 ES 1 - CS 5: Worker exposure: Formulation or re-packing (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	3 ppm (ECETOC TRA worker v3, long-term)	0,15
inhalative	12 ppm (ECETOC TRA worker v3, short-term)	0,24
dermal	0,69 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.6 ES 1 - CS 6: Worker exposure: Formulation or re-packing (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	5 ppm (ECETOC TRA worker v3, long-term)	0,25
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.7 ES 1 - CS 7: Worker exposure: Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	5 ppm (ECETOC TRA worker v3, long-term)	0,25
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.8 ES 1 - CS 8: Worker exposure: Formulation or re-packing (Mixing or blending in batch processes) (PROC5)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	5 ppm (ECETOC TRA worker v3, long-term)	0,25
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

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1.3.9 ES 1 - CS 9: Worker exposure: Formulation or re-packing (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	10 ppm (ECETOC TRA worker v3, long-term)	0,5
inhalative	40 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.10 ES 1 - CS 10: Worker exposure: Formulation or re-packing (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	10 ppm (ECETOC TRA worker v3, long-term)	0,5
inhalative	40 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.11 ES 1 - CS 11: Worker exposure: Formulation or re-packing (Transfer of substance or mixture into small containers (dedicated filling line, including weighing)) (PROC9)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	5 ppm (ECETOC TRA worker v3, long-term)	0,25
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

1.3.12 ES 1 - CS 12: Worker exposure: Formulation or re-packing (Use as laboratory reagent) (PROC15)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	5 ppm (ECETOC TRA worker v3, long-term)	0,25
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	0,34 mg/kg bw/day (ECETOC TRA worker v3)	

1.4. ES 1 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Health

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects.

Risk management measures are based on qualitative risk characterisation.

Available hazard data do not enable the derivation of a DNEL for eye irritant effects.

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Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Further details on scaling and control technologies are provided in SPERC factsheet.

2. ES 2: Widespread use by professional workers; Use in oil and gas field drilling and production operations, off-shore

2.1. Title section

Environment		
CS1:	Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8d
Workers		
CS2:	Widespread use by professional workers (General measures applicable to all activities)	CS135
CS3:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS4:	Widespread use by professional workers (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC3
CS5:	Widespread use by professional workers (Chemical production where opportunity for exposure arises)	PROC4
CS6:	Widespread use by professional workers (Chemical production where opportunity for exposure arises)	PROC4
CS7:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS9:	Widespread use by professional workers (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS10:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS11:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS12:	Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS13:	Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS14:	Widespread use by professional workers (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2

2.2. ES 2 Conditions of use affecting exposure

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2.2.1 ES 2 - CS 1: Control of environmental exposure: Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Product characteristics

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Non-hydrophobic

Amount used

Amounts used (Msafe) : 316.000 kg/day

Other given operational conditions affecting environmental exposure

Number of emission days per year : 365
Remarks : Wide dispersive use, Continuous process

Technical conditions and measures / Organizational measures

Remarks : Prevent environmental discharge consistent with regulatory requirements.

Waste management measures

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations., Dispose of waste product or used containers according to local regulations., This material and its container must be disposed of as hazardous.

2.2.2 ES 2 - CS 2: Control of worker exposure: Widespread use by professional workers (General measures applicable to all activities) (CS135)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %
Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Assumes use at not more than 20°C above ambient temperature.

Frequency and duration of use

Exposure duration : 12 h
Remarks : Continuous process

Other operational conditions affecting workers exposure

Remarks : Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure there is no direct skin contact with product.
Identify potential areas for indirect skin contact.
Clear spills immediately.
Wash off any skin contamination immediately.

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Ensure operatives are trained to minimise exposures.
Avoid direct eye contact with product, also via contamination on hands.
Avoid splashing.

Personal protective measures : Use suitable eye protection.
For further specification, refer to section 8 of the SDS.

Personal protective measures : In case of potential exposure:
Wear suitable gloves tested to EN374.
For further specification, refer to section 8 of the SDS.

2.2.3 ES 2 - CS 3: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Remarks : Bulk transfers from tote tanks and supply vessels
Filling of equipment from drums or containers

Risk Management Measures

Note : No other specific measures identified.

2.2.4 ES 2 - CS 4: Control of worker exposure: Widespread use by professional workers (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Remarks : Drilling mud (re-)formulation
Treatment and disposal of filtered solids
Process sampling

Risk Management Measures

Note : No other specific measures identified.

2.2.5 ES 2 - CS 5: Control of worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Drill floor operations
Scale squeeze operations

Risk Management Measures

Note : No other specific measures identified.

2.2.6 ES 2 - CS 6: Control of worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Operation of solids filtering equipment
With potential for aerosol generation

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Elevated temperature

Risk Management Measures

Technical conditions and measures : Provide extract ventilation to points where emissions occur.

2.2.7 ES 2 - CS 7: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

2.2.8 ES 2 - CS 8: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Ensure operation is undertaken outdoors.

2.2.9 ES 2 - CS 9: Control of worker exposure: Widespread use by professional workers (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Remarks : Application by injection

Risk Management Measures

Note : No other specific measures identified.

2.2.10 ES 2 - CS 10: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

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Technical conditions and measures : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Use drum pumps or carefully pour from container.

2.2.11 ES 2 - CS 11: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Technical conditions and measures : Ensure operation is undertaken outdoors.
Use drum pumps or carefully pour from container.

2.2.12 ES 2 - CS 12: Control of worker exposure: Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

2.2.13 ES 2 - CS 13: Control of worker exposure: Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Ensure operation is undertaken outdoors.

2.2.14 ES 2 - CS 14: Control of worker exposure: Widespread use by professional workers (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Remarks : General exposures
Closed systems
Storage

Risk Management Measures

Note : No other specific measures identified.

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2.3. ES 2 Exposure estimation and reference to its source

2.3.1 ES 2 - CS 1: Environmental release and exposure: Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Release route	Release rate	Release estimation method
Air	0 %	
Water	100 %	
Soil	0 %	

protection target	Exposure estimation and reference to its source (CHARM model)	RCR
Marine water	0,000381 mg/L (Risk from environmental exposure is driven by marine water.)	< 0,01
Marine sediment	0,000924 µg/kg dry weight	< 0,01

2.3.3 ES 2 - CS 3: Worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

2.3.4 ES 2 - CS 4: Worker exposure: Widespread use by professional workers (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4 ppm (ECETOC TRA worker v3, long-term)	0,2
inhalative	12 ppm (ECETOC TRA worker v3, short-term)	0,24
dermal	0,69 mg/kg bw/day (ECETOC TRA worker v3)	

2.3.5 ES 2 - CS 5: Worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
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inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.6 ES 2 - CS 6: Worker exposure: Widespread use by professional workers
(Chemical production where opportunity for exposure arises) (PROC4)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.7 ES 2 - CS 7: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)
(PROC8a)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.8 ES 2 - CS 8: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)
(PROC8a)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.9 ES 2 - CS 9: Worker exposure: Widespread use by professional workers
(Chemical production or refinery in closed process without likelihood of exposure or
processes with equivalent containment conditions) (PROC1)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	0,013 ppm (ECETOC TRA worker v3, long-term)	< 0,01
inhalative	0,0399 ppm (ECETOC TRA worker v3, short-term)	< 0,01
dermal	0,03 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.10 ES 2 - CS 10: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)**

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(PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.11 ES 2 - CS 11: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)
(PROC8a)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.12 ES 2 - CS 12: Worker exposure: Widespread use by professional workers
(Manual maintenance (cleaning and repair) of machinery) (PROC28)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.13 ES 2 - CS 13: Worker exposure: Widespread use by professional workers
(Manual maintenance (cleaning and repair) of machinery) (PROC28)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**2.3.14 ES 2 - CS 14: Worker exposure: Widespread use by professional workers
(Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	1,4 mg/kg bw/day (ECETOC TRA worker v3)	

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2.4. ES 2 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Health

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects.

Risk management measures are based on qualitative risk characterisation.

Available hazard data do not enable the derivation of a DNEL for eye irritant effects.

3. ES 3: Widespread use by professional workers; Use in oil and gas field drilling and production operations, on-shore

3.1. Title section

Environment		
CS1:	Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor))	ERC8d
Workers		
CS2:	Widespread use by professional workers (General measures applicable to all activities)	CS135
CS3:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS4:	Widespread use by professional workers (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC3
CS5:	Widespread use by professional workers (Chemical production where opportunity for exposure arises)	PROC4
CS6:	Widespread use by professional workers (Chemical production where opportunity for exposure arises)	PROC4
CS7:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS8:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS9:	Widespread use by professional workers (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS10:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS11:	Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS12:	Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS13:	Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS14:	Widespread use by professional workers (Chemical production or refinery in closed continuous process with occasional controlled	PROC2

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exposure or processes with equivalent containment conditions)

3.2. ES 3 Conditions of use affecting exposure

3.2.1 ES 3 - CS 1: Control of environmental exposure: Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Product characteristics

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Non-hydrophobic

Amount used

Amounts used (Msafe) : 7.930 kg/day

Other given operational conditions affecting environmental exposure

Number of emission days per year : 365
Remarks : Wide dispersive use, Continuous process

Technical conditions and measures / Organizational measures

Remarks : Bund storage facilities to prevent soil and water pollution in the event of spillage.
Prevent environmental discharge consistent with regulatory requirements.

Conditions and measures related to sewage treatment plant

Type of Sewage Treatment Plant : Onsite Sewage Treatment Plant
Flow rate of sewage treatment plant effluent : 2.000 m3/d
Effectiveness (of a measure) : 87 %

Waste management measures

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations., Dispose of waste product or used containers according to local regulations., This material and its container must be disposed of as hazardous.

3.2.2 ES 3 - CS 2: Control of worker exposure: Widespread use by professional workers (General measures applicable to all activities) (CS135)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks : Assumes use at not more than 20°C above ambient temperature.

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Frequency and duration of use

Exposure duration : 12 h
Remarks : Continuous process

Other operational conditions affecting workers exposure

Remarks : Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure there is no direct skin contact with product.
Identify potential areas for indirect skin contact.
Clear spills immediately.
Wash off any skin contamination immediately.
Ensure operatives are trained to minimise exposures.
Avoid direct eye contact with product, also via contamination on hands.
Avoid splashing.

Personal protective measures : Use suitable eye protection.
For further specification, refer to section 8 of the SDS.

Personal protective measures : In case of potential exposure:
Wear suitable gloves tested to EN374.
For further specification, refer to section 8 of the SDS.

3.2.3 ES 3 - CS 3: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Remarks : Bulk transfers from tote tanks and supply vessels
Filling of equipment from drums or containers

Risk Management Measures

Note : No other specific measures identified.

3.2.4 ES 3 - CS 4: Control of worker exposure: Widespread use by professional workers (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Remarks : Drilling mud (re-)formulation
Treatment and disposal of filtered solids
Process sampling

Risk Management Measures

Note : No other specific measures identified.

3.2.5 ES 3 - CS 5: Control of worker exposure: Widespread use by professional

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workers (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Drill floor operations
Scale squeeze operations

Risk Management Measures

Note : No other specific measures identified.

3.2.6 ES 3 - CS 6: Control of worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Operation of solids filtering equipment
With potential for aerosol generation
Elevated temperature

Risk Management Measures

Technical conditions and measures : Provide extract ventilation to points where emissions occur.

3.2.7 ES 3 - CS 7: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

3.2.8 ES 3 - CS 8: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Ensure operation is undertaken outdoors.

3.2.9 ES 3 - CS 9: Control of worker exposure: Widespread use by professional workers (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Remarks : Application by injection

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Risk Management Measures

Note : No other specific measures identified.

3.2.10 ES 3 - CS 10: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Technical conditions and measures : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).
Use drum pumps or carefully pour from container.

3.2.11 ES 3 - CS 11: Control of worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Technical conditions and measures : Ensure operation is undertaken outdoors.
Use drum pumps or carefully pour from container.

3.2.12 ES 3 - CS 12: Control of worker exposure: Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

3.2.13 ES 3 - CS 13: Control of worker exposure: Widespread use by professional workers (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Ensure operation is undertaken outdoors.

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3.2.14 ES 3 - CS 14: Control of worker exposure: Widespread use by professional workers (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Remarks : General exposures
Closed systems
Storage

Risk Management Measures

Note : No other specific measures identified.

3.3. ES 3 Exposure estimation and reference to its source

3.3.1 ES 3 - CS 1: Environmental release and exposure: Widespread use by professional workers (Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)) (ERC8d)

Release route	Release rate	Release estimation method
Air	0,5 %	
Water	7 %	
Soil	0 %	

protection target	Exposure estimation and reference to its source (ECETOC TRA)	RCR
Sewage treatment plant	0,623 mg/L	< 0,01
Freshwater	0,152 mg/L (Risk from environmental exposure is driven by freshwater.)	0,02
Freshwater sediment	0,596 mg/kg dry weight (Risk from environmental exposure is driven by freshwater sediment.)	0,02
Soil	0,0000359 mg/kg dry weight	< 0,01

3.3.3 ES 3 - CS 3: Worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.4 ES 3 - CS 4: Worker exposure: Widespread use by professional workers

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(Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4 ppm (ECETOC TRA worker v3, long-term)	0,2
inhalative	12 ppm (ECETOC TRA worker v3, short-term)	0,24
dermal	0,69 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.5 ES 3 - CS 5: Worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.6 ES 3 - CS 6: Worker exposure: Widespread use by professional workers (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	13 ppm (ECETOC TRA worker v3, long-term)	0,67
inhalative	39,9 ppm (ECETOC TRA worker v3, short-term)	0,8
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.7 ES 3 - CS 7: Worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.8 ES 3 - CS 8: Worker exposure: Widespread use by professional workers (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23

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inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**3.3.9 ES 3 - CS 9: Worker exposure: Widespread use by professional workers
(Chemical production or refinery in closed process without likelihood of exposure or
processes with equivalent containment conditions) (PROC1)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	0,013 ppm (ECETOC TRA worker v3, long-term)	< 0,01
inhalative	0,0399 ppm (ECETOC TRA worker v3, short-term)	< 0,01
dermal	0,03 mg/kg bw/day (ECETOC TRA worker v3)	

**3.3.10 ES 3 - CS 10: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)
(PROC8a)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**3.3.11 ES 3 - CS 11: Worker exposure: Widespread use by professional workers
(Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)
(PROC8a)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**3.3.12 ES 3 - CS 12: Worker exposure: Widespread use by professional workers
(Manual maintenance (cleaning and repair) of machinery) (PROC28)**

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

**3.3.13 ES 3 - CS 13: Worker exposure: Widespread use by professional workers
(Manual maintenance (cleaning and repair) of machinery) (PROC28)**

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Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4,7 ppm (ECETOC TRA worker v3, long-term)	0,23
inhalative	14 ppm (ECETOC TRA worker v3, short-term)	0,28
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

3.3.14 ES 3 - CS 14: Worker exposure: Widespread use by professional workers (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	1,4 mg/kg bw/day (ECETOC TRA worker v3)	

3.4. ES 3 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Health

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects.

Risk management measures are based on qualitative risk characterisation.

Available hazard data do not enable the derivation of a DNEL for eye irritant effects.

4. ES 4: Use at industrial sites; Use in oil and gas field drilling and production operations, off-shore

4.1. Title section

Environment		
CS1:	Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))	ERC4
Workers		
CS2:	Use at industrial sites (General measures applicable to all activities)	CS135
CS3:	Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities)	PROC8b
CS4:	Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)	PROC3
CS5:	Use at industrial sites (Chemical production where opportunity for exposure arises)	PROC4
CS6:	Use at industrial sites (Chemical production where opportunity for exposure arises)	PROC4
CS7:	Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a

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CS8:	Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS9:	Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS10:	Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS11:	Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS12:	Use at industrial sites (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS13:	Use at industrial sites (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS14:	Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2

4.2. ES 4 Conditions of use affecting exposure

4.2.1 ES 4 - CS 1: Control of environmental exposure: Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Product characteristics

Physical Form (at time of use)	: Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks	: Non-hydrophobic

Amount used

Daily amount per site	: 137 kg/day
Annual amount per site	: 50 tonnes/year
Daily amount per site (Msafe)	: 316.000 kg

Other given operational conditions affecting environmental exposure

Number of emission days per year	: 365
Remarks	: Continuous process, Continuous release

Technical conditions and measures / Organizational measures

Remarks	: Prevent environmental discharge consistent with regulatory requirements.
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Waste management measures

Waste treatment	: External treatment and disposal of waste should comply with applicable local and/or national regulations., Dispose of waste product or used containers according to local regulations., This material and its container must be disposed of as hazardous.
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4.2.2 ES 4 - CS 2: Control of worker exposure: Use at industrial sites (General measures applicable to all activities) (CS135)

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Product characteristics

Concentration of the Substance in Mixture/Article : ≤ 100 %

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure

Remarks : Assumes use at not more than 20°C above ambient temperature.

Frequency and duration of use

Exposure duration : 12 h

Remarks : Continuous process

Other operational conditions affecting workers exposure

Remarks : Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure there is no direct skin contact with product.
Identify potential areas for indirect skin contact.
Clear spills immediately.
Wash off any skin contamination immediately.
Ensure operatives are trained to minimise exposures.
Avoid direct eye contact with product, also via contamination on hands.
Avoid splashing.

Personal protective measures : Use suitable eye protection.
For further specification, refer to section 8 of the SDS.

Personal protective measures : In case of potential exposure:
Wear suitable gloves tested to EN374.
For further specification, refer to section 8 of the SDS.

4.2.3 ES 4 - CS 3: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Remarks : Bulk transfers from tote tanks and supply vessels
Filling of equipment from drums or containers

Risk Management Measures

Note : No other specific measures identified.

4.2.4 ES 4 - CS 4: Control of worker exposure: Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Remarks : Drilling mud (re-)formulation
Treatment and disposal of filtered solids
Process sampling

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Risk Management Measures

Note : No other specific measures identified.

4.2.5 ES 4 - CS 5: Control of worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Drill floor operations
Scale squeeze operations

Risk Management Measures

Note : No other specific measures identified.

4.2.6 ES 4 - CS 6: Control of worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Operation of solids filtering equipment
With potential for aerosol generation
Elevated temperature

Risk Management Measures

Technical conditions and measures : Provide extract ventilation to points where emissions occur.

4.2.7 ES 4 - CS 7: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

4.2.8 ES 4 - CS 8: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

Technical conditions and measures : Drain down system prior to equipment break-in or

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measures

maintenance.

4.2.9 ES 4 - CS 9: Control of worker exposure: Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Remarks : Application by injection

Risk Management Measures

Note : No other specific measures identified.

4.2.10 ES 4 - CS 10: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Technical conditions and measures : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

4.2.11 ES 4 - CS 11: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

4.2.12 ES 4 - CS 12: Control of worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

4.2.13 ES 4 - CS 13: Control of worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

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Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

4.2.14 ES 4 - CS 14: Control of worker exposure: Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Remarks : General exposures
Closed systems
Storage
With sample collection

Risk Management Measures

Note : No other specific measures identified.

4.3. ES 4 Exposure estimation and reference to its source

4.3.1 ES 4 - CS 1: Environmental release and exposure: Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Release route	Release rate	Release estimation method
Air	0 %	(Initial release prior to RMM)
Water	100 %	(Initial release prior to RMM)
Soil	0 %	(Initial release prior to RMM)

protection target	Exposure estimation and reference to its source (CHARM model)	RCR
Marine water	0,000381 mg/L (Risk from environmental exposure is driven by marine water.)	< 0,01
Marine sediment	0,000924 µg/kg dry weight	< 0,01

4.3.3 ES 4 - CS 3: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.4 ES 4 - CS 4: Worker exposure: Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional

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controlled exposure or processes with equivalent containment condition) (PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4 ppm (ECETOC TRA worker v3, long-term)	0,2
inhalative	12 ppm (ECETOC TRA worker v3, short-term)	0,24
dermal	0,69 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.5 ES 4 - CS 5: Worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.6 ES 4 - CS 6: Worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	2,7 ppm (ECETOC TRA worker v3, long-term)	0,13
inhalative	7,98 ppm (ECETOC TRA worker v3, short-term)	0,16
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.7 ES 4 - CS 7: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,9 ppm (ECETOC TRA worker v3, long-term)	0,09
inhalative	5,59 ppm (ECETOC TRA worker v3, short-term)	0,11
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.8 ES 4 - CS 8: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,9 ppm (ECETOC TRA worker v3, long-term)	0,09
inhalative	5,59 ppm (ECETOC TRA worker v3, short-term)	0,11
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

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4.3.9 ES 4 - CS 9: Worker exposure: Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	0,013 ppm (ECETOC TRA worker v3, long-term)	< 0,01
inhalative	0,0399 ppm (ECETOC TRA worker v3, short-term)	< 0,01
dermal	0,03 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.10 ES 4 - CS 10: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.11 ES 4 - CS 11: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.12 ES 4 - CS 12: Worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

4.3.13 ES 4 - CS 13: Worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

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4.3.14 ES 4 - CS 14: Worker exposure: Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,3 ppm (ECETOC TRA worker v3, long-term)	0,07
inhalative	3,99 ppm (ECETOC TRA worker v3, short-term)	0,08
dermal	1,4 mg/kg bw/day (ECETOC TRA worker v3)	

4.4. ES 4 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Health

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects.

Risk management measures are based on qualitative risk characterisation.

Available hazard data do not enable the derivation of a DNEL for eye irritant effects.

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

5. ES 5: Use at industrial sites; Use in oil and gas field drilling and production operations, on-shore

5.1. Title section

Environment		
CS1: Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article))		ERC4
Workers		
CS2: Use at industrial sites (General measures applicable to all activities)		CS135
CS3: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities)		PROC8b
CS4: Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition)		PROC3
CS5: Use at industrial sites (Chemical production where opportunity for exposure arises)		PROC4
CS6: Use at industrial sites (Chemical production where opportunity for exposure arises)		PROC4
CS7: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)		PROC8a
CS8: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)		PROC8a

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CS9: Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions)	PROC1
CS10: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS11: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities)	PROC8a
CS12: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS13: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery)	PROC28
CS14: Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions)	PROC2

5.2. ES 5 Conditions of use affecting exposure

5.2.1 ES 5 - CS 1: Control of environmental exposure: Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Product characteristics

Physical Form (at time of use)	: Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure
Remarks	: Non-hydrophobic

Amount used

Annual amount per site	: 50 tonnes/year
Daily amount per site	: 137 kg/day
Daily amount per site (Msafe)	: 7.930 kg

Environment factors not influenced by risk management

Dilution Factor (River)	: 10
Dilution Factor (Coastal Areas)	: 100

Other given operational conditions affecting environmental exposure

Number of emission days per year	: 365
Remarks	: Continuous process, Continuous release

Technical conditions and measures / Organizational measures

Water	: Do not let product enter drains.
Remarks	: Bund storage facilities to prevent soil and water pollution in the event of spillage. Prevent environmental discharge consistent with regulatory requirements.

Conditions and measures related to sewage treatment plant

Type of Sewage Treatment Plant	: Onsite Sewage Treatment Plant
Flow rate of sewage treatment plant effluent	: 2.000 m3/d
Effectiveness (of a measure)	: 87 %

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Waste management measures

Waste treatment : External treatment and disposal of waste should comply with applicable local and/or national regulations., Dispose of waste product or used containers according to local regulations., This material and its container must be disposed of as hazardous.

5.2.2 ES 5 - CS 2: Control of worker exposure: Use at industrial sites (General measures applicable to all activities) (CS135)

Product characteristics

Concentration of the Substance in Mixture/Article : <= 100 %

Physical Form (at time of use) : Liquid, vapour pressure < 0.5 kPa at Standard Temperature and Pressure

Remarks : Assumes use at not more than 20°C above ambient temperature.

Frequency and duration of use

Exposure duration : 12 h

Remarks : Continuous process

Other operational conditions affecting workers exposure

Remarks : Assumes a good basic standard of occupational hygiene is implemented

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure there is no direct skin contact with product.
Identify potential areas for indirect skin contact.
Clear spills immediately.
Wash off any skin contamination immediately.
Ensure operatives are trained to minimise exposures.
Avoid direct eye contact with product, also via contamination on hands.
Avoid splashing.

Personal protective measures : Use suitable eye protection.
For further specification, refer to section 8 of the SDS.

Personal protective measures : In case of potential exposure:
Wear suitable gloves tested to EN374.
For further specification, refer to section 8 of the SDS.

5.2.3 ES 5 - CS 3: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

Remarks : Bulk transfers from tote tanks and supply vessels
Filling of equipment from drums or containers

Risk Management Measures

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Note : No other specific measures identified.

5.2.4 ES 5 - CS 4: Control of worker exposure: Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Remarks : Drilling mud (re-)formulation
Treatment and disposal of filtered solids
Process sampling

Risk Management Measures

Note : No other specific measures identified.

5.2.5 ES 5 - CS 5: Control of worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Drill floor operations
Scale squeeze operations

Risk Management Measures

Note : No other specific measures identified.

5.2.6 ES 5 - CS 6: Control of worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Remarks : Operation of solids filtering equipment
With potential for aerosol generation
Elevated temperature

Risk Management Measures

Technical conditions and measures : Provide extract ventilation to points where emissions occur.

5.2.7 ES 5 - CS 7: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

5.2.8 ES 5 - CS 8: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

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Remarks : Cleaning of solids filtering equipment

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

Technical conditions and measures : Drain down system prior to equipment break-in or maintenance.

5.2.9 ES 5 - CS 9: Control of worker exposure: Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Remarks : Application by injection

Risk Management Measures

Note : No other specific measures identified.

5.2.10 ES 5 - CS 10: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Technical conditions and measures : Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).

5.2.11 ES 5 - CS 11: Control of worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Remarks : Transfer from/pouring from containers

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

5.2.12 ES 5 - CS 12: Control of worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Technical conditions and measures : Provide a good standard of general ventilation (not less than 3

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measures to 5 air changes per hour).

5.2.13 ES 5 - CS 13: Control of worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Remarks : Equipment cleaning and maintenance

Risk Management Measures

Organisational measures to prevent /limit releases, dispersion and exposure : Ensure operation is undertaken outdoors.

5.2.14 ES 5 - CS 14: Control of worker exposure: Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Remarks : General exposures
Closed systems
Storage
With sample collection

Risk Management Measures

Note : No other specific measures identified.

5.3. ES 5 Exposure estimation and reference to its source

5.3.1 ES 5 - CS 1: Environmental release and exposure: Use at industrial sites (Use of non-reactive processing aid at industrial site (no inclusion into or onto article)) (ERC4)

Release route	Release rate	Release estimation method
Air	0,5 %	(Initial release prior to RMM)
Water	7 %	(Initial release prior to RMM)
Soil	0 %	(Initial release prior to RMM)

protection target	Exposure estimation and reference to its source ()	RCR
Sewage treatment plant	0,623 mg/L	< 0,01
Freshwater	0,152 mg/L (Risk from environmental exposure is driven by freshwater.)	0,02
Freshwater sediment	0,596 mg/kg dry weight	0,02
Soil	0,0000359 mg/kg dry weight	< 0,01

5.3.3 ES 5 - CS 3: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at dedicated facilities) (PROC8b)

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Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.4 ES 5 - CS 4: Worker exposure: Use at industrial sites (Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition) (PROC3)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	4 ppm (ECETOC TRA worker v3, long-term)	0,2
inhalative	12 ppm (ECETOC TRA worker v3, short-term)	0,24
dermal	0,69 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.5 ES 5 - CS 5: Worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	6,7 ppm (ECETOC TRA worker v3, long-term)	0,33
inhalative	20 ppm (ECETOC TRA worker v3, short-term)	0,4
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.6 ES 5 - CS 6: Worker exposure: Use at industrial sites (Chemical production where opportunity for exposure arises) (PROC4)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	2,7 ppm (ECETOC TRA worker v3, long-term)	0,13
inhalative	7,98 ppm (ECETOC TRA worker v3, short-term)	0,16
dermal	6,9 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.7 ES 5 - CS 7: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,9 ppm (ECETOC TRA worker v3, long-term)	0,09
inhalative	5,59 ppm (ECETOC TRA worker v3, short-term)	0,11
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.8 ES 5 - CS 8: Worker exposure: Use at industrial sites (Transfer of substance or

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mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,9 ppm (ECETOC TRA worker v3, long-term)	0,09
inhalative	5,59 ppm (ECETOC TRA worker v3, short-term)	0,11
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.9 ES 5 - CS 9: Worker exposure: Use at industrial sites (Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions) (PROC1)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	0,013 ppm (ECETOC TRA worker v3, long-term)	< 0,01
inhalative	0,0399 ppm (ECETOC TRA worker v3, short-term)	< 0,01
dermal	0,03 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.10 ES 5 - CS 10: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.11 ES 5 - CS 11: Worker exposure: Use at industrial sites (Transfer of substance or mixture (charging/discharging) at non dedicated-facilities) (PROC8a)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.12 ES 5 - CS 12: Worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

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5.3.13 ES 5 - CS 13: Worker exposure: Use at industrial sites (Manual maintenance (cleaning and repair) of machinery) (PROC28)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	9,3 ppm (ECETOC TRA worker v3, long-term)	0,47
inhalative	27,9 ppm (ECETOC TRA worker v3, short-term)	0,56
dermal	14 mg/kg bw/day (ECETOC TRA worker v3)	

5.3.14 ES 5 - CS 14: Worker exposure: Use at industrial sites (Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions) (PROC2)

Route of exposure and type of effects	Exposure estimate	RCR
inhalative	1,3 ppm (ECETOC TRA worker v3, long-term)	0,07
inhalative	3,99 ppm (ECETOC TRA worker v3, short-term)	0,08
dermal	1,4 mg/kg bw/day (ECETOC TRA worker v3)	

5.4. ES 5 Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Health

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects.

Risk management measures are based on qualitative risk characterisation.

Available hazard data do not enable the derivation of a DNEL for eye irritant effects.

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites;

thus, scaling may be necessary to define appropriate site-specific risk management measures.



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Gujarat, INDIA.

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9974013523/ 9909949962

Email:- Info@jaydinesh.com ; export@jaydinesh.com

Shree Jay Ambe



Jay Dinesh Chemicals
Quality is Priority

Factory: Plot No.184-186, Nr. Clearis Life Science,
Vill Chacharwadi vasana, Sarkhej bavla highway,
TA, Sanand, Dist. Ahmedabad- 382 213
Gujarat, INDIA.

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+91 9979317523

Websight: www.jaydinesh.com

SAFTEY DATA SHEET

Oxygen Scavenger

1 Identification

Product identifier

Trade name: Oxygen Scavenger

EC number: 207-837-2

Application of the substance / the mixture

Controls oxygen pitting in low and high pressure steam boilers.

Details of the supplier of the safety data sheet

Manufacturer/Supplier

Manufactured by: Jay Dinesh Chemical Survey No. 184 to 186, Nr. Claris Village Chacharawadi – Vasna,
Sarkhej Bawla Highway, Ta. Sanad, Dist Ahmedabad-382213.

Information department

Customer Service Department - Jay Dinesh Chemicals

Contact: Mis. Purvi. Shah.

e-mail: exports@jaydinesh.com

Emergency telephone number

During normal opening time:- +917878730626

2 Hazard(s) Identification

Classification of the Substance or Mixture

Classification (GHS-US)

Skin Irrit. 2	H315
Eye Irrit. 2A	H319
Carc. 1A	H350
STOTRE 1	H372

Label elements

GHS label elements

Hazard pictograms



Signal word: Danger



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9974013523/ 9909949962

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Vill Chacharwadi vasana, Sarkhej bavla highway,
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Hazard statements

Causes serious eye damage.

Precautionary statements

Wear protective gloves/protective clothing/eye protection/face protection

Supplemental Hazard Statements none

Other hazards

Lachrymator

3 Composition/information on ingredients

Chemical characterization: Substances

Mixture

Chemical Name	CAS No	Weight-%
Proprietary	Proprietary	7-13
Proprietary	Proprietary	5-10
Proprietary	Proprietary	<5

4 First-Aid Measures

Description of first aid measures

After inhalation: Remove to fresh air.

After skin contact: Wash off immediately with plenty of water for at least 15 minutes.

After eye contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center or doctor/physician.

After swallowing: If symptoms persist consult doctor.

Information for doctor:

Indication of any immediate medical attention and special treatment needed

No further relevant information available.

5 Fire-Fighting Measures

Extinguishing media

Suitable extinguishing agents:

Water spray, dry foam, carbon dioxide.

Special hazards arising from the substance or mixture: In the presence of fire, this product may produce sulfur dioxide. May react with active metals (aluminum, zinc and magnesium) liberating hydrogen gas.

Advice for firefighters



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Protective equipment: As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH

6 Accidental Release Measures

Personal precautions, protective equipment and emergency procedures: Use personal protective equipment as required

Environmental precautions: Do not let product enter drains

Methods and material for containment and cleaning up:

Small spills: Soak up with an inert absorbent and place in designated disposal container. Large spills: Spills should be contained and soaked up with an inert absorbent and place in designated disposal container to await proper treatment or disposal.

7 Handling and Storage

Handling:

Precautions for safe handling

Handle in accordance with good industrial hygiene and safety practice. Wear protective gloves/protective clothing and eye/face protection

Information about protection against explosions and fires: No special measures required.

Conditions for safe storage, including any incompatibilities

Storage

Requirements to be met by storerooms and receptacles: Store in cool, dry conditions and well ventilated area.

Information about storage in one common storage facility: Do not store together with acids.

Further information about storage conditions: Keep containers tightly closed when not in use. Store away from heat, open flames and incompatible materials. Store in cool, dry, ventilated area. Keep from freezing. Keep out of reach of children

Specific end use(s) No further relevant information available.

8 Exposure Controls/Personal Protection

Additional information about design of technical systems: No further data; see item 7.

Control parameters

Components with limit values that require monitoring at the workplace: Not required.

Additional information: The lists that were valid during the creation were used as basis.

Exposure controls

Personal protective equipment:

General protective and hygienic measures:



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Keep away from foodstuffs, beverages and feed. Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.

Avoid contact with the eyes.

Avoid contact with the eyes and skin.

Breathing equipment:

In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.

Protection of hands:

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be

Eye protection:



Tightly sealed goggles

9 Physical and Chemical Properties

Information on basic physical and chemical properties

General Information

Appearance:	Clear, pale amber to water, water white liquid
Odor:	Odorless
Odor threshold :	No data available

pH-value: 6-8

Change in condition

Melting point/Melting range:	Not determined
Boiling point/Boiling range:	100 °C / 212 °F

Specific gravity / density 1.185

Flash point: Not applicable.

Flammability (solid, gaseous): Not applicable.

Ignition temperature:

Decomposition temperature: Not determined



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Auto igniting:	Not determined
Danger of explosion:	No data available
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapor pressure:	Not determined.
Density:	Not determined.
Relative density:	Not determined.
Vapor density:	Not determined.
Evaporation rate:	Not applicable.
Solubility in / Miscibility with Water:	Miscible in water
Partition coefficient (n-octanol/water):	Not applicable.
Viscosity:	No data available

10 Stability and Reactivity

Reactivity :Not reactive under normal conditions

Chemical stability : Stable under recommended storage conditions

Thermal decomposition / conditions to be avoided: This is a stable product under normal (ambient) temperature and pressure.

Possibility of hazardous reactions: Under normal conditions of storage and use, hazardous polymerization will not occur.

Conditions to avoid:Moisture. Avoid creating or spreading dust.

Incompatible materials: Strong acids. Metals. Halogens.

Hazardous decomposition products: No data available .

11 Toxicological Information

Information on toxicological effects

Acute toxicity:

LD50 Oral - Rat: 502 - 638 mg/kg

LC50 Inhalation - Rat - male and female: > 2.1 mg/l (4h)
(OECD Test Guideline 403)

Dermal: No data available

Primary irritant effect:

on the skin:

Avoid contact with skin

on the eye:

Causes serious eye damage



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Sensitization:

mouse

Result: Does not cause skin sensitization. (OECD Test Guideline 429)

Additional toxicological information:

Carcinogenic categories

IARC (International Agency for Research on Cancer):

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification

No component of this product, present at levels greater than or equal to 0.1%, is identified as probable, possible or confirmed human carcinogen by IARC

NTP (National Toxicology Program):

No component of this product, present at levels greater than or equal to 0.1%, is identified as a known or anticipated carcinogen by NTP.

OSHA-Ca (Occupational Safety & Health Administration) :

No component of this product, present at levels greater than or equal to 0.1%, is identified as a carcinogen or potential carcinogen by OSHA.

12 Ecological Information

Toxicity

Aquatic toxicity:

No further relevant information available.

Persistence and degradability:

No further relevant information available.

Behavior in environmental systems

Bioaccumulative potential:

No further relevant information available.

Mobility in soil:

No further relevant information available.

Additional ecological information:

General notes:

Water hazard class 1 (Self-assessment): slightly hazardous for water

Do not allow undiluted product or large quantities of it to reach

Results of PBT and vPvB assessment

PBT:

Not applicable.

vPvB:

Not applicable.

Other adverse effects:

No further relevant information available.

13 Disposal Considerations (non-mandatory)

Waste treatment methods

Recommendation:



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Dispose of product and contaminated packaging in accordance with all local, state, and federal environmental control regulations

Uncleaned packagings

Recommendation: Disposal must be made according to official regulations

14 Transport Information (non-mandatory)

UN-Number	
DOT, ADR, ADN, IMDG, IATA	Void
UN proper shipping name	
DOT, ADN, IMDG, IATA	Void
ADR	Void
Transport hazard class(es)	
DOT	
Class	Void
ADR, ADN, IMDG, IATA	
Class	Not restricted for transport
Packing group	
DOT, ADR, IMDG, IATA	Void
Environmental hazards	
Marine pollutant	No
Special precautions for user	Not applicable.
UN "Model Regulation"	Void

15 Regulatory Information (non-mandatory)

substance or mixture

Section 355 (extremely hazardous substances): Substance is not listed.

Section 313 (Specific toxic chemical listings): Substance is not listed.

TSCA (Toxic Substances Control Act): Substance is listed.

Proposition 65

Chemicals known to cause cancer: Substance is not listed.

Chemicals known to cause reproductive toxicity for females: Substance is not listed.

Chemicals known to cause reproductive toxicity for males: Substance is not listed.

Chemicals known to cause developmental toxicity: Substance is not listed.

Carcinogenic categories



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EPA (Environmental Protection Agency):

Substance is not listed.

TLV (Threshold Limit Value established by ACGIH):

Substance is not listed.

**NIOSH-Ca (National Institute for Occupational
Safety and Health):**

Substance is not listed.

GHS label elements:

The substance is classified and labeled according to the

Hazard pictograms



GHS05

Signal word:

Danger

Hazard statements:

Causes serious eye damage.

Precautionary statements:

Wear eye protection / face protection. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/doctor.

Chemical safety assessment:

A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Department issuing SDS: Quality Control Department

Contact: Mis Purvi. Shah.

e-mail: exports@jaydinesh.com

Date of preparation / last revision 04/18/2019 / -

Abbreviations and acronyms:

NFPA health hazard

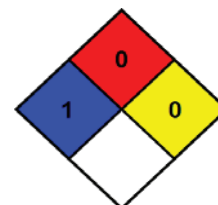
1 - Materials that, under emergency conditions, can cause significant irritation.

NFPA fire hazard

0 - Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand.

NFPA reactivity

0 - Material that in themselves are normally stable, even under fire conditions.



Data compared to the previous version altered.

Revision Information: 01/2016, Sections 1, 2 revised - Information department and GHS label.

Revision Information: 01/2017, Added new ABCT Logo



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IMPIANTO SMALL SCALE LNG PLANT

Collesanto gas field

Elenco dei consumi elettrici e fluidi ausiliari di impianto

-	01	07/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
-	00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
	Rev. Indice					
CONTRATTATORE				Titolo Progetto		
		Engea Consulting				
		DG Impianti				
		ITALFLUID Cosmep	IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field			
CLIENTE						
		LNEnergy				
				Scala	foglio/di	
				A4	1	2
Titolo Documento				Doc. Codice		
				Doc. Pos		
Elenco dei consumi elettrici e fluidi ausiliari di impianto						
Software: Microsoft Excel				File name 0		

  	ENGEA Consulting	CONTRATTORE													
	DG impianti														
	ITALFLUID Cosmep														
			01	07/11/2023	EMISSIONE PER ENTI							DG Impianti	ITF Cosmep	ITF Cosmep	
			00	06/10/2023	EMISSIONE PER ENTI							DG Impianti	ITF Cosmep	ITF Cosmep	
	LNenergy	CLIENTE	REV.	DATA	Elenco dei consumi elettrici e fluidi ausiliari di impianto							ELABORATO	VERIFICATO	APPROVATO	

	UNITA'	ITEM	DESCRIZIONE	ELEC. POWER	FUELS		NITROGEN	INSTRUMENT AIR (Nota 2)	WATER		HOT OIL	DRY AMINE	CHEMICALS			NOTES
					FUEL GAS (Nota 1)	DIESEL GAS per emergenza			DEMI WATER	SERVICE/RAW WATER			Antifoam	Oxygen Scavenger	Corrosion Inhibitor	
					[Sm3/h]	[litri/anno]			[m3/h]	[m3/h]			[kg/h]	[kg/h]	[kg/h]	
	190		CHEMICAL INJECTION UNIT										0.025	0.025	0.025	
	200		LNG PLANT INLET					5								
	330		AMINE SWEETENING	188.69				6	0.12		37.96	0.0002				Stima rimbocco annuale ammine , calcolato pari lo spurgo (20%circolante/8000 h di funzionamento)
	310		DEHYDRATATION	4							6.30					
	340		REFRIGERATION & LIQUEFACTION	4547.4			5	25.5			30.37					
	220		LNG STORAGE	34.46			3									
	350		ISOCONTAINER													
	360		ACID GAS RECOVERY AND TREATMENT UNIT	22.27												
	380		FLASH GAS	96.6				6								
	410		HOT OIL		114.0		2									
	480		POWER GENERATION UNIT		1366.8	2000			0.1		5.32					
	230		FLARE		2											
	650		NITROGEN GENERATOR UNIT													
	480		CONTROL ROOM WITH PLC CABINET / UPS / ESD													
	520		LOCAL ELETRICAL UNIT													
	250		ELECTROLYZER	1200						0.56						
	500		INSTRUMENT AIR PACKAGE UNIT	100												
	550		COOLING WATER													
	580		CLOSED DRAIN SYSTEM													
	990		SHELTERS							0.20						
	780		FISCAL MEETERING													
	490		INLINE ANALYZERS													
	530		WWT, DEMI & POTABLE WATER PACKAGE					7.5								
	730		FIRE & GAS & FIREFIGHTING UNIT							0.01						L'acqua prodotta durante il processo, al netto dei consumi totali è destinata all' Antincendio e all'irrigazione dopo adeguato trattamento all'interno dell'impianto
	NA		HVAC for Shelters and Buildings	1000												
				[kW]	[Sm3/h]	litri/anno	[Nm3/h]	[Nm3/h]	[m3/h]	[m3/h]	[m3/h]	[m3/h]	[kg/h]	[kg/h]	[kg/h]	
			TOTALE	7204.4	1482.8	2000.0	10.0	56.0	0.22	0.770	79.95	0.0002	0.0250	0.0250	0.0250	

NOTE

- Nota 1 Gas prodotto e utilizzato internamente al processo
- Nota 2 Sono indicati i consumi principali. L'aria strumenti è comunque disponibile a tutte le unità.

IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field

Elenco delle emissioni liquidi, solide e gassose

-	01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
-	00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
STATO	Rev. n.	DATA	DESCRIZIONE	ELABORATO	VERIFICATO	APPROVATO
Rev. Indice						
CONTRATTATORE  Engea Consulting  DG Impianti  ITALFLUID Cosmep				Titolo Progetto IMPIANTO SMALL SCALE LNG PLANT Collesanto gas field		
CLIENTE  LNEnergy						
				Scala A4	foglio/di 1 di 6	
Titolo Documento Elenco delle emissioni liquidi, solide e gassose				Doc. Codice		
				Doc. Pos		

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep		01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNEnergy	CLIENTE	REV.	DATA	Lista Emissioni Gassose CONTINUE in Atmosfera (Nota generale : Funzionamento 8000 h / anno)	ELABORATO	VERIFICATO	APPROVATO
Q.tà Totale		Composizione		Note			Condizioni di rilascio in ATM	
54678,4 Nm ³ /d 57681 Sm ³ /d		N ₂ 99 %mol		Proveniente da Unità 340 - REFRIGERATION & LIQUEFACTION			T = 25 °C	
		CH ₄ 1 %mol					P = ATM	
792038 Nm ³ /d 835532 Sm ³ /d		Ossidi di zolfo (come SO2) <= 160 mg/Nm3		Proveniente da Unità 480 - POWER GENERATION UNIT (Questo scarico, già convogliato ad opportuno si stema di abbattimento catalitico De-NOx e De-SOx, può essere convogliato ad un opportuno sistema addizionale di cattura e recupero della CO2 per riduzione emissione GHG)			T = 318 °C	
		Ossidi di azoto (come NO2) <= 700 mg/Nm3					P = ATM	
		Monossido di Carbonio (CO) < 100 mg/Nm3						
		Sostanze organiche volatili (TOC) < 10 mg/Nm ³						
		Polveri < 10 mg/Nm ³						
6440 Nm ³ /d 6793,9 Sm ³ /d		Ossidi di zolfo (come SO2) ≤ 1200 mg/Nm ³		Proveniente da Unità 230 - Hot Flare with Oxidizer (incluso un camino di by-pass, con pilota, in grado di assicurare una efficienza minima di combustione del 99% espressa come CO ₂ /(CO ₂ +CO)			T = 991 °C	
		Ossidi di azoto (come NO2) ≤ 350 mg/Nm ³					P = ATM	
		H ₂ S ≤ 10 mg/Nm ³						
		CO ≤ 100 mg/Nm ³						
		TOC ≤ 20 mg/Nm ³						
		Polveri ≤ 10 mg/Nm ³						

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep		01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNEnergy	CLIENTE	REV.	DATA	Lista Emissioni Gassose DISCONTINUE in Atmosfera (Nota generale : Previste SOLO durante scenario di EMERGENZA)	ELABORATO	VERIFICATO	APPROVATO
Q.tà Totale				Composizione		Note		Condizioni di rilascio in ATM
50.000 Sm ³ /d		CH ₄ 78,68 %mol		Proveniente da Unità 230 - COLD FLARE (In caso di emergenza il volume di gas intrappolato nelle unità di processo deve poter essere scaricato in atmosfera in concomitanza con l'intervento automatico del sistema ESD (Emergency Shut Down), nel ri-spetto delle normative internazionali API RP 520 e 521.)			T = 40 °C P = ATM	
		CO ₂ 6994 ppmv						
		H ₂ S 2695 ppmv (Nota 1)						
		N ₂ 21,32 %mol						
231839 Sm3/d 219770 Nm3/d		Ossidi di zolfo (come SO2) < 800 mg/Nm3		Proveniente da Unità 480 - EDG (Emergency Diesel Generator) (Questo scarico in atmosfera è previsto SOLO durante il caso di EMERGENZA in cui il gruppo ausiliario alimentato a combustibile DIESEL è in grado di alimentare le utenze eltttriche di emergenza dell'impianto per portare lo stesso in condizioni di SICUREZZA)			T = 150 °C P = ATM	
		Ossidi di azoto (come NO2) < 3500 mg/Nm3						
		Monossido di Carbonio (CO) < 100 mg/Nm3						
		Sostanze organiche volatili (COT) < 10 mg/Nm ³						
		Polveri < 10 mg/Nm ³						

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep							
			01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNEnergy	CLIENTE	REV.	DATA	Lista Emissioni Liquide in ambiente (Nota generale : Funzionamento 8000 h / anno)	ELABORATO	VERIFICATO	APPROVATO
Q.tà Totale		Composizione		Note			Condizioni di rilascio in ATM	
NA		NA		Emissioni liquide Non sono previste emissioni liquide nell'ambiente L'impianto per la produzione di LNG attraverso la tecnologia innovativa di Small Scale LNG è stato progettato adottando la filosofia Zero-Liquid Discharge (ZLD) ovvero Scarico Liquidi Zero. Nota 1, Nota 2, Nota 3			-	

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep		01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNenergy	CLIENTE	REV.	DATA	Lista Emissioni Solide in ambiente (Nota generale : Funzionamento 8000 h / anno)	ELABORATO	VERIFICATO	APPROVATO
Q.tà Totale		Composizione		Note				Condizioni di rilascio in ATM
NA		NA		Emissioni solide Non sono previste emissioni solide nell'ambiente. Nota 1, Nota 3				-

  	ENGEA Consulting	CONTRATTORE						
	DG impianti							
	ITALFLUID Cosmep		01	14/11/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
			00	06/10/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
	LNenergy	CLIENTE	REV.	DATA	Note al documento : Lista Emissioni Liquide in Atmosfera (Nota generale : Funzionamento 8000 h / anno)	ELABORATO	VERIFICATO	APPROVATO
Nota 1	Gestione dei Rifiuti Durante le attività in progetto, nella fase di cantiere e di esercizio verranno prodotti dei rifiuti, riconducibili alle seguenti categorie: • rifiuti assimilabili al tipo urbano Codice CER 200000 e CER 15 01 (Codici esemplificativi: lattine - CER 20 01 40 e CER 15 01 04 , cartoni - CER 200101 e CER 15 01 01, legno CER 200138, stracci CER 15 02); • acque reflue (acque di lavaggio impianto ed acque meteoriche); • liquami civili (codice esemplificativo CER 20 03 04) In ogni caso, tutti i reflui prodotti saranno temporaneamente raccolti nel cantiere, in strutture e con modalità adeguate per ciascuna specifica tipologia, per poter essere successivamente smaltiti ad idoneo recapito. Gli stessi vengono prodotti e smaltiti gradualmente nel corso delle attività, così da ridurre al minimo i quantitativi temporaneamente depositati in sito. I Rifiuti Solidi Urbani ed assimilabili, vengono smaltiti attraverso i normali sevizi di nettezza urbana. Per quanto riguarda gli altri rifiuti prodotti in cantiere, si evitano processi di trattamento in area, che comporterebbero: • acquisizione di altre aree per la sistemazione degli impianti e delle attrezzature di corredo; • attuazione di processi di trattamento chimico-fisici; • presenza ulteriore di personale; pertanto, tali rifiuti sono depositati temporaneamente in sito, suddivisi per categoria omogenea, e poi smaltiti presso opportuni recapiti (depuratori, discariche autorizzate, industrie per produzione di laterizi).							
	Nota 2	Scarichi Idrici Sono previsti canali idrici superficiali di raccolta delle acque piovane che saranno successivamente trattate e stoccate in appositi serbatoi di raccolta per riuso interno all’impianto (TK-740 A/B). I reflui civili prodotti verranno convogliati in apposito sistema di raccolta Imhoff e smaltiti secondo Norme vigenti. Per quanto riguarda gli scarichi idrici di drenaggio derivante dalle attività di processo, anch’essi saranno trattati e stoccati per riuso interno all’impianto negli stessi serbatoi di raccolta indicati precedentemente. I closed drain dell’impianto, ovvero gli stoccaggi chiusi in cui conferiscono spurghi delle attività di processo destinati a smaltimento presso fornitore autorizzato (codice esemplificativo : CER 16 10 - rifiuti liquidi acquosi destinati ad essere trattati fuori sito) , sono i seguenti: Closed drain HC drum (volume = 12 m3) - serbatoio di stoccaggio che riceve gli spurghi provenienti dall’impianto a composizione prevalentemente idrocarburica Closed drain amine drum (volume = 12 m3) - serbatoio di stoccaggio che riceve gli spurghi di ammina provenienti dall’unità di addolcimento del gas Closed drain Process Condensate drum (volume = 12 m3) - acqua contenente idrocarburi e condense processo. Lo smaltimento è previsto a cadenza trimestrale salvo diversa esigenze operative e di manutenzione.						
Nota 3		Per quanto riguarda i rifiuti specificatamente legati alle attività di produzione dell’LNG nell’impianto si rimanda al Documento "Elenco dei consumi di chimici, materiali consumabili e commodities"						

PLANIMETRIA DI RIPRISTINO
AL TERMINE DI ESERCIZIO
SMALL SCALE LNG (dopo
20 anni)

AREA DI RIPRISTINO
IMPIANTO SMALL
SCALE LNG
Nota (3)

AREA DI RIPRISTINO
AREA MINIERARIA MP1 & MP2
Nota (1)

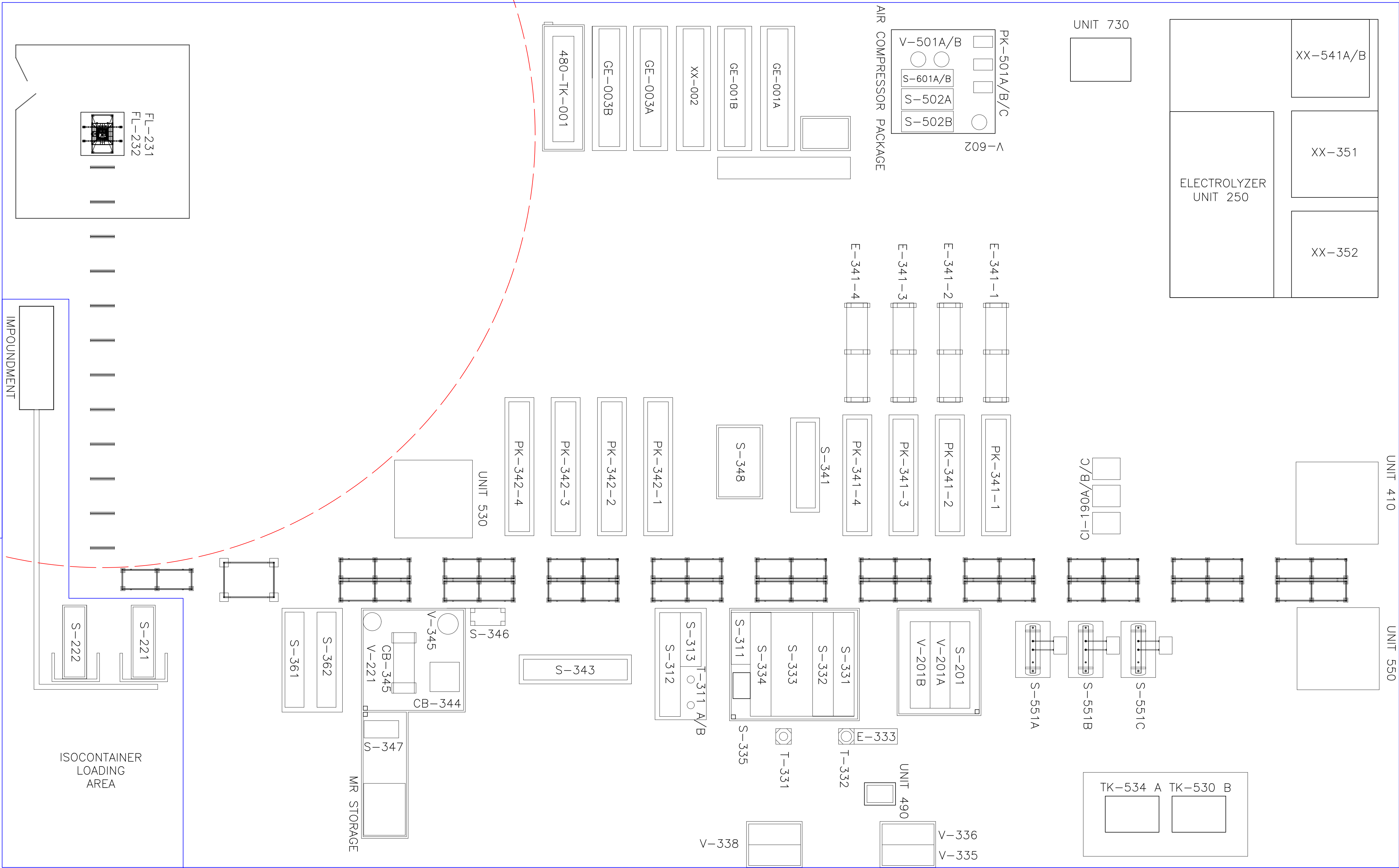
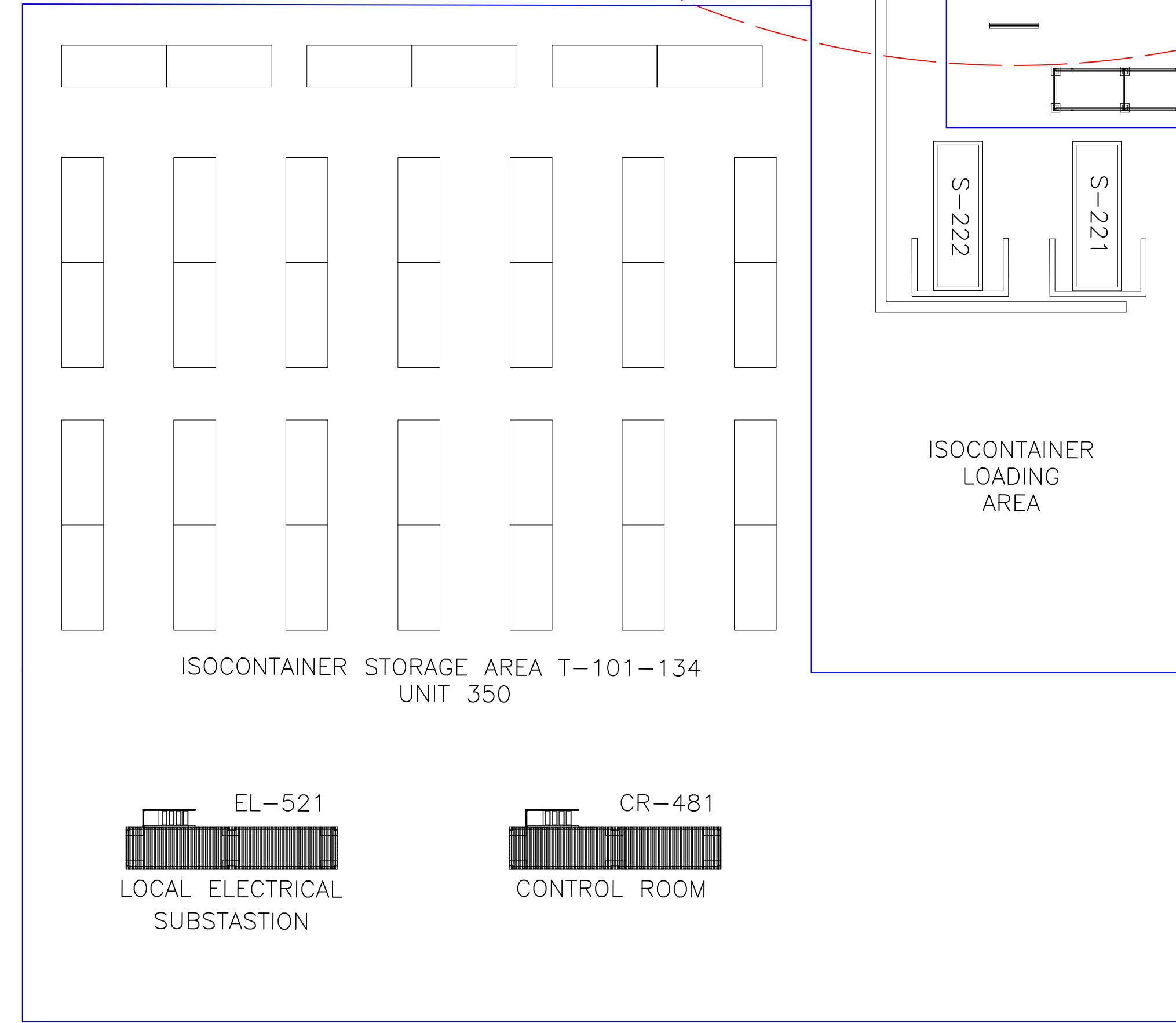
AREA DI
COSTRUZIONE PER
SMALL SCALE LNG
Nota (2)

Note:

- (1) Per i pozzi MP1 & MP2 si prevede chiusura mineraria. I manufatti in C.A. demoliti e smaltiti. Ripristino strato erboso superficiale ed eventuale ripiantumazione a quota 315.00.
- (2) L'area di costruzione verrà completamente ripristinata all'uso originario e verranno eseguite le necessarie opere di compensazione previste dalla Legge Regionale, già al termine della fase di costruzione dell'impianto Small Scale LNG.
- (3) Per l'area impianto verrà effettuato il decommissioning delle attrezzature e relativo smaltimento. I manufatti in C.A. demoliti e smaltiti. Ripristino strato erboso superficiale ed eventuale ripiantumazione a quota 315.00.

NOTE:
— AREA DI INTERVENTO
— CURVE DI LIVELLO

01	Novembre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Engineering Management Contracting			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SMALL SCALE LNG PLANT		
PLANIMETRIA			Monte Pallano 1-2 (MP1 and MP2)		
DENOMINAZIONE FILE:			POSIZIONE DOCUMENTO:		
—			1006/09		
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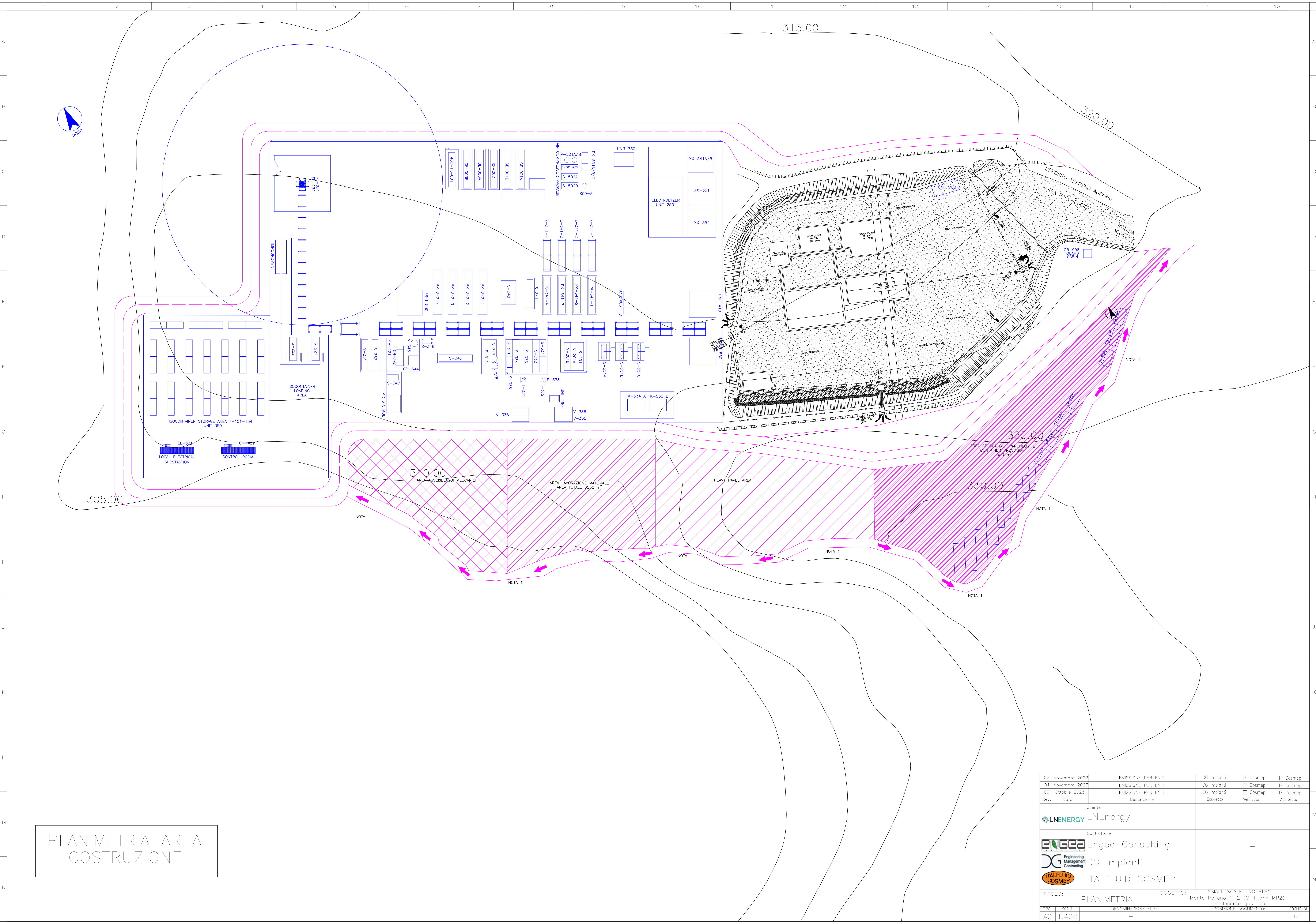
PLANIMETRIA AREA IMPIANTO

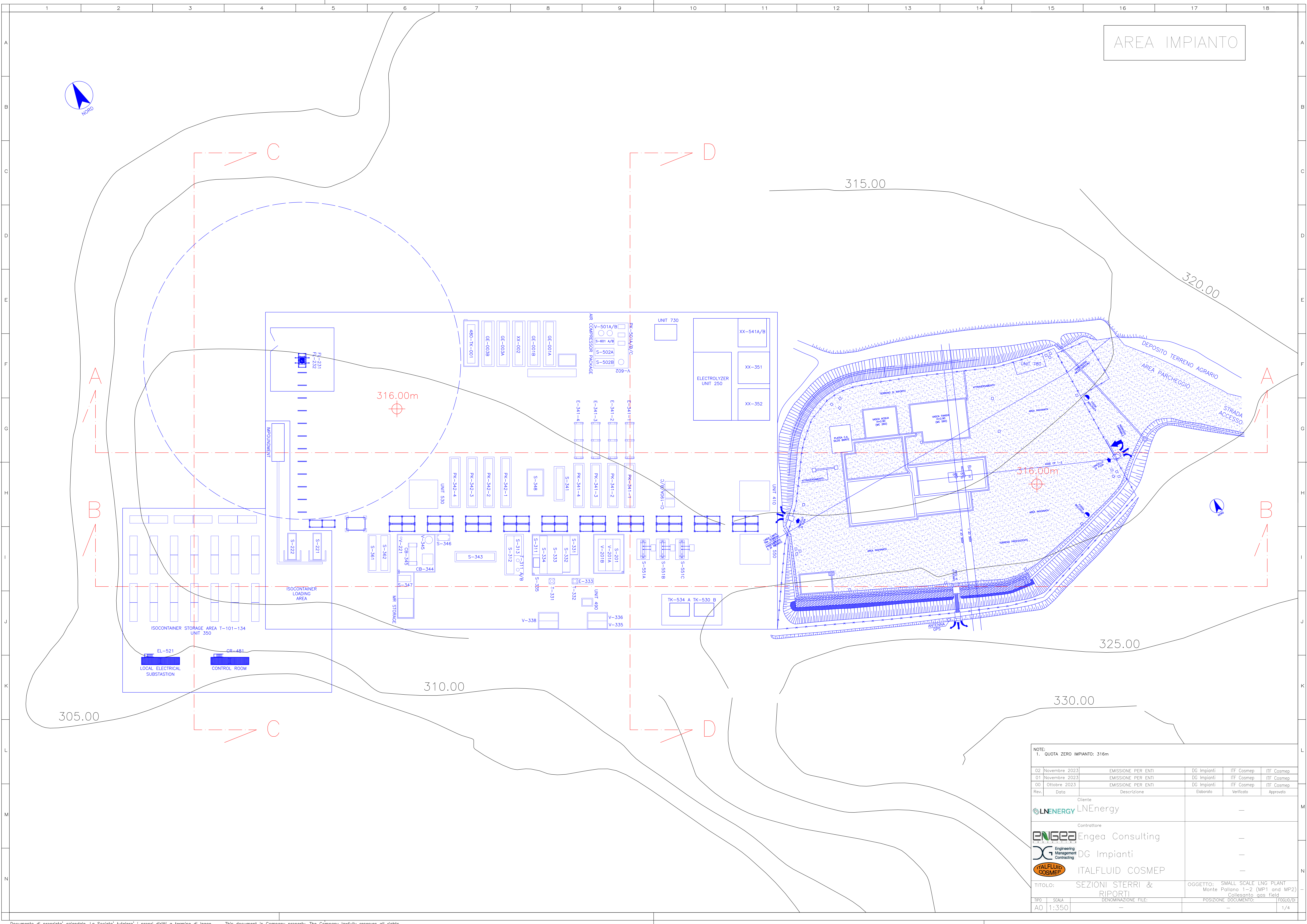
15		16		17		18	
UNITA	ITEM	DESCRIZIONE					
190	CHEMICAL INJECTION UNIT						
190	CI-190 A	CHEMICAL INJECTION PACKAGE					
190	CI-190 B	CHEMICAL INJECTION PACKAGE					
190	CI-190 C	CHEMICAL INJECTION PACKAGE					
200	LNG PLANT INLET						
200	S-201	INLET SKID					
200	V-201 A	INLET RAW GAS SEPARATOR					
200	V-201 B	HG GUARD TRAP					
330	AMINE SWEETENING						
330	S-331	AMINE INLET SKID					
330	S-332	AMINE LEAN/RICH SKID					
330	T-331	AMINE CONTACTOR/ABSORBER					
330	T-332	AMINE REGENERATOR					
330	E-333	AMINE REBOILER					
330	S-333	AMINE LEAN SKID					
330	S-334	AMINE REFUX SKID					
330	S-335	FRESH AMINE/WATER MAKEUP					
330	V-335	DEMINEALIZED WATER SOLUTION TANK					
330	V-336	FRESH AMINE TANK					
330	V-338	EXHAUST AMINE STORAGE TANK					
310	DEHYDRATATION						
310	S-311	DEHY INLET-OUTLET SKID					
310	S-312	DEHY REGENERATION SKID					
310	T-311A	ADSORBER BED					
310	T-311B	ADSORBER BED					
340	REFRIGERATION & LIQUEFACTION						
340	PK-341-1	AMMONIA COMPRESSOR PACKAGE					
340	PK-341-2	AMMONIA COMPRESSOR PACKAGE					
340	PK-341-3	AMMONIA COMPRESSOR PACKAGE					
340	PK-341-4	AMMONIA COMPRESSOR PACKAGE					
340	E-341-1	OIL COOLER 1					
340	E-341-2	OIL COOLER 2					
340	E-341-3	OIL COOLER 3					
340	E-341-4	OIL COOLER 4					
340	S-341	AMMONIA CONDENSER WITH LIQUID RECEIVER					
340	PK-342-1	MR COMPRESSOR PACKAGE					
340	PK-342-2	MR COMPRESSOR PACKAGE					
340	PK-342-3	MR COMPRESSOR PACKAGE					
340	PK-342-4	MR COMPRESSOR PACKAGE					
340	S-343	MR PRECOOLING					
340	CB-344	COLD BOX					
340	CB-345	NITROGEN REJECTION UNIT					
340	S-346	NGL and Condensate vaporizer skid (used also for hot nitrogen cold box defreezing)					
340	S-347	MR REFRIGERANT MAKEUP					
340	V-345	MR SUCTION KO DRUM					
340	S-348	OIL REMOVAL SYSTEM					
220	LNG STORAGE						
220	V-221	LNG SEPARATOR					
220	S-221	LOADING STATION #1					
220	S-222	LOADING STATION #2					
350	ISOCONTAINER						
350	T-101-...-134	ISOCONTAINER					
360	ACID GAS RECOVERY AND TREATMENT UNIT						
360	XX-351	RIMOZIONE H2S					
360	XX-352	CO2 CAPTURE & RECOVERY					
380	FLASH GAS						
380	S-361	FLASH GAS COMPRESSOR					
380	S-362	BOG RECYCLE GAS COMPRESSOR					
410	HOT OIL						
410	XX-410	HOT OIL PACKAGE					
480	POWER GENERATION UNIT						
480	GE-001 T1 THROUGHOUT	TURBO GAS GENERATOR with HRSG					
480	GE-001 T2 THROUGHOUT	TURBO GAS GENERATOR with HRSG					
480	XX-002 (S) TURBINE + ST	STEAM TURBINES PACKAGE with BFW System					
480	GE-003 A	EDG					
480	GE-003 B	EDG					
480	TK-001	DIESEL TANK					
230	FLARE						
230	FL-231	HOT FLARE WITH OXYDIZER					
230	FL-232	COLD VERTICAL EMERGENCY FLARE					
650	NITROGEN GENERATOR UNIT						
650	S-601 A	NITROGEN GENERATOR					
650	S-601 B	NITROGEN GENERATOR					
650	V-602	N2 RECEIVER					
480	CONTROL ROOM WITH PLC CABINET / UPS / ESD						
480	CR-481	CONTROL ROOM WITH PLC CABINET / UPS / ESD					
520	LOCAL ELECTRICAL UNIT						
520	EL-521	ELECTRICAL SUBSTATION					
250	ELECTROLYZER						
250	XX-551	ELECTROLYZER PACKAGE					
500	INSTRUMENT AIR PACKAGE UNIT						
500	PK-501 A	COMPRESSED AIR PACKAGE					
500	PK-501 B	COMPRESSED AIR PACKAGE					
500	PK-501 C	COMPRESSED AIR PACKAGE					
500	V-501 A	WET AIR RECEIVER					
500	V-501 B	WET AIR RECEIVER					
500	S-502 A	IA DRIER					
500	S-502 B	IA DRIER					
550	COOLING WATER						
550	XX-551	COOLING WATER PACKAGE					
580	CLOSED DRAIN SYSTEM						
580	S-551 A	CLOSED DRAIN HC DRUM					
580	S-551 B	CLOSED DRAIN AMINE DRUM					
580	S-551 C	CLOSED DRAIN PC DRUM					
990	SHELTERS						
990	XX-991	LABORATORY PACKAGE					
990	CB-992	WAREHOUSE CABIN					
990	CB-993	WORKSHOP CABIN					
990	CB-994	OFFICE CABIN					
990	CB-995	MATERIAL STOCK CONTAINER					
990	CB-996	INFIRMARY CABIN					
990	CB-997	TOILET CABIN					
990	CB-998	GUARD CABIN					
730	FISCAL MEETING						
730	XX-731	FISCAL MEETING PACKAGE					
490	INLINE ANALYZERS						
490	XX-491	INLINE ANALYZERS PACKAGE					
530	WWT, DEMI & POTABLE WATER PACKAGE						
530	F-531 A/B	PROCESS WATER FILTERS -50um					
530	F-532 A/B	PROCESS WATER FILTERS -10um					
530	V-532 A/B	OILY WATER PACKAGE					
530	XX-531 A/B	REVERSE OSMOSIS PACKAGE					
530	TK-530 A	WATER REUSE TANK					
530	TK-530 B	WATER REUSE TANK					
730	FIRE & GAS & FIREFIGHTING UNIT						
730	XX - 731	FIREFIGHTING PUMPS SKID					
730	TK-731 A	FW TANK					
730	TK-731 B	FW TANK					
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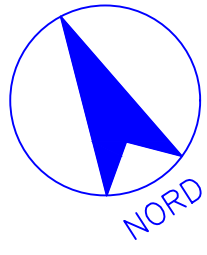
PLANIMETRIA AREA
COSTRUZIONE

02	Novembre 2023	EMISSIONE PER ENTI	DC Impianti	ITF Cosmep	ITF Cosmep
01	Novembre 2023	EMISSIONE PER ENTI	DC Impianti	ITF Cosmep	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI	DC Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy					
Contrattore					
ENGEA Engea Consulting					
DG Engineering Management Contracting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
ITALFLUID COSMEP			—		
TITOLO:		OGGETTO:			
PLANIMETRIA		SMALL SCALE LNG PLANT Monte Pallano 1-2 (MP1 and MP2) - Collesanto gas field			
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOGLIO
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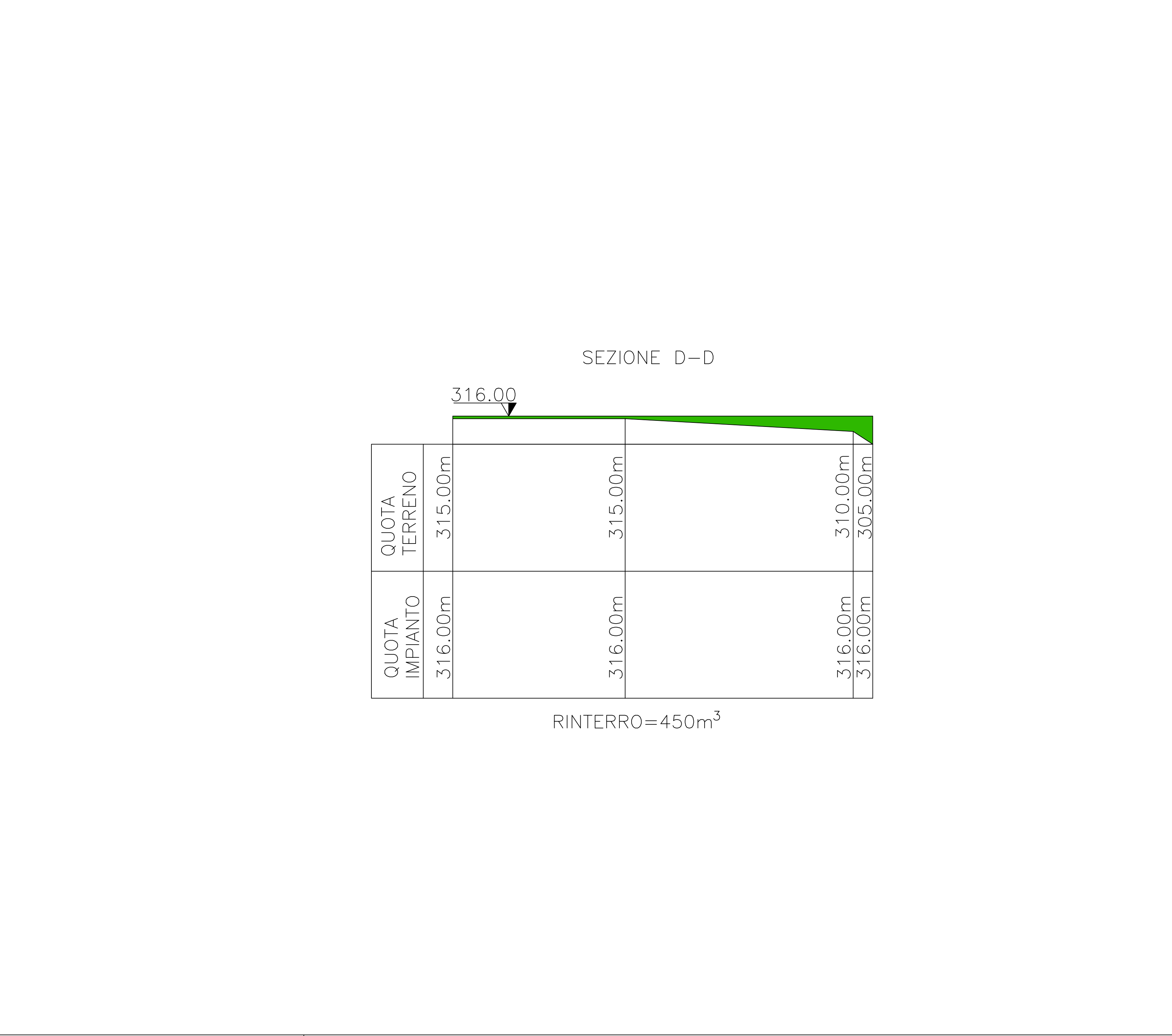
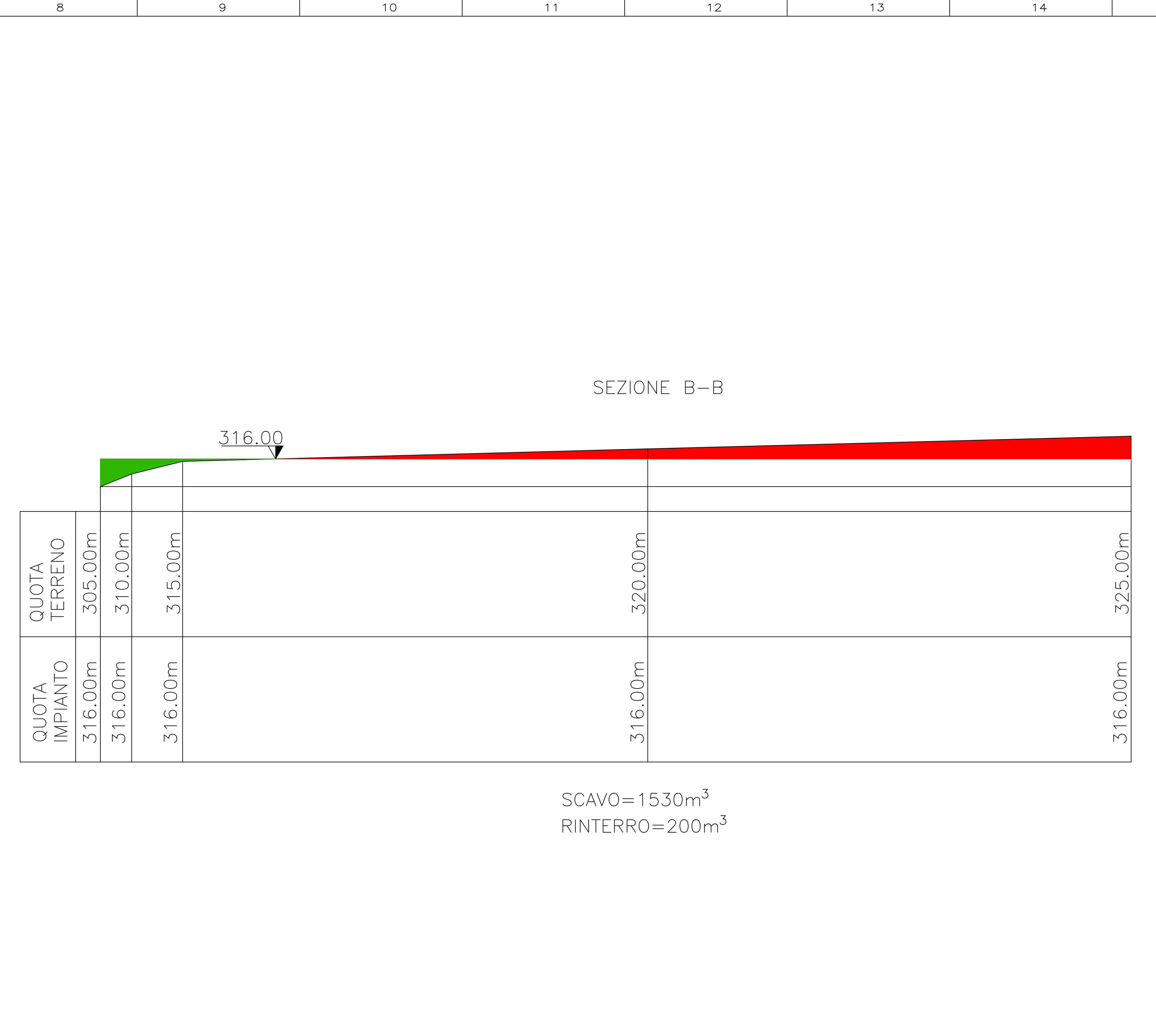
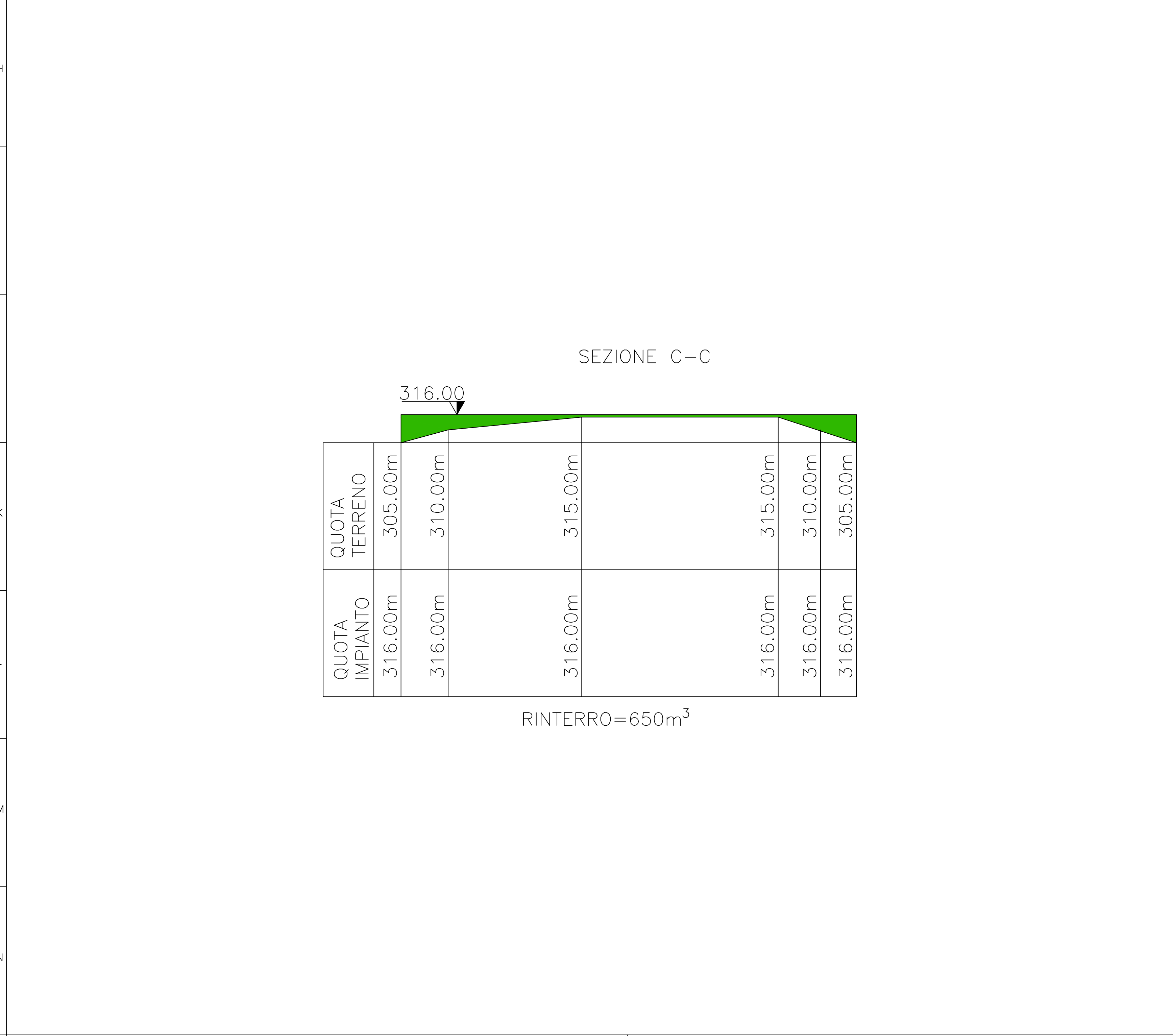
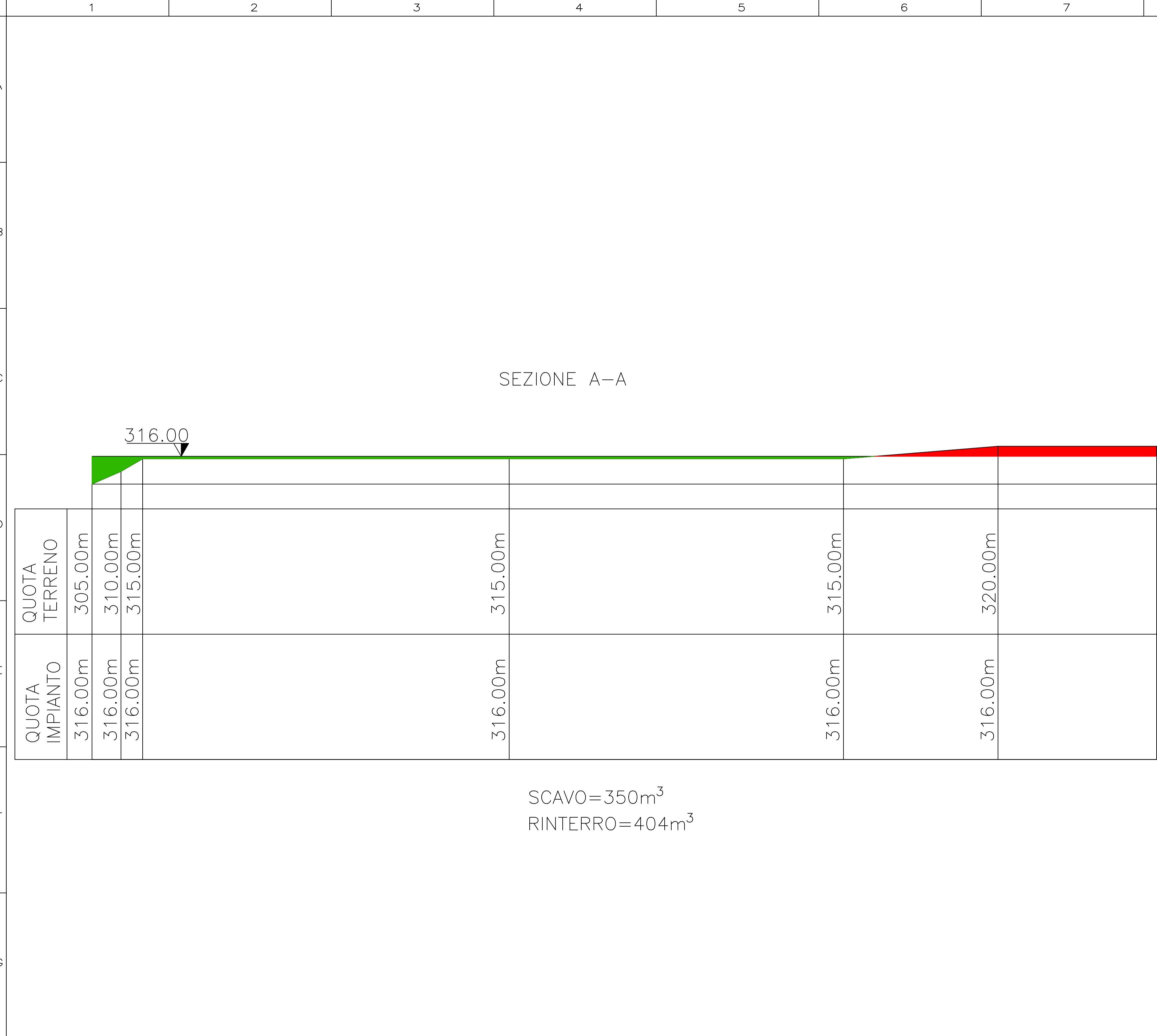




AREA IMPIANTO



NOTE: 1. QUOTA ZERO IMPIANTO: 316m				
02	Novembre 2023	EMISSIONE PER ENTI	OG Impianti	ITF Cosmep
01	Novembre 2023	EMISSIONE PER ENTI	OG Impianti	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI	OG Impianti	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato
Cliente			—	
Contruttore			—	
OG Impianti			—	
ITALFLUID COSMEP			—	
TITOLO: SEZIONI STERRI & RIPORTI			OGGETTO: SMALL SCALE LNG PLANT Monte Pallano 1-2 (MP1 and MP2) Collesanto gas field	
BENOMINAZIONE FILE:			POSIZIONE DOCUMENTO:	
TIPO	SCALA			FOGLIO/8
A0	1:350	—		1/4



15

16

17

18

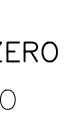
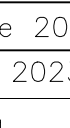
AREA IMPIANTO

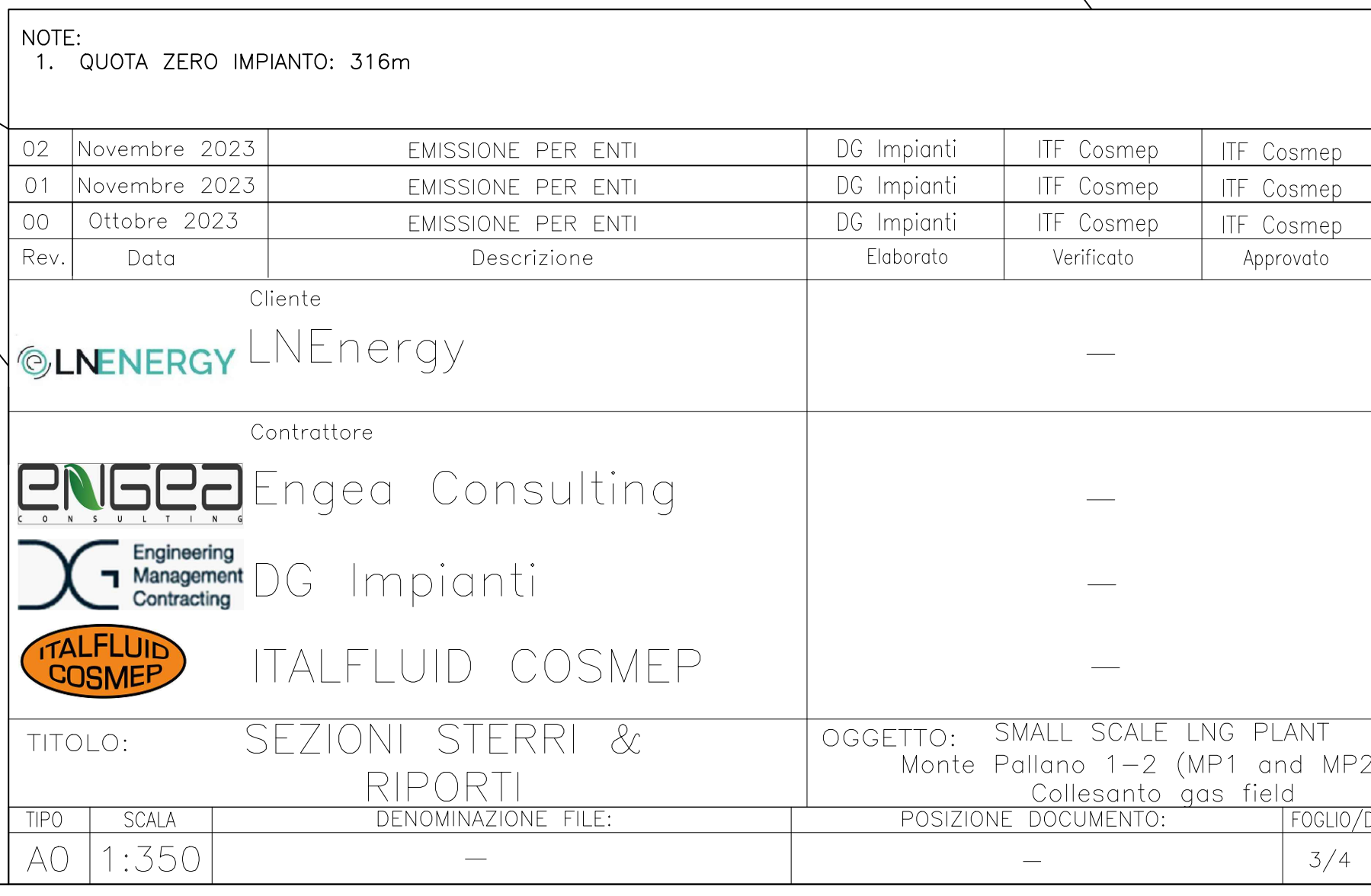
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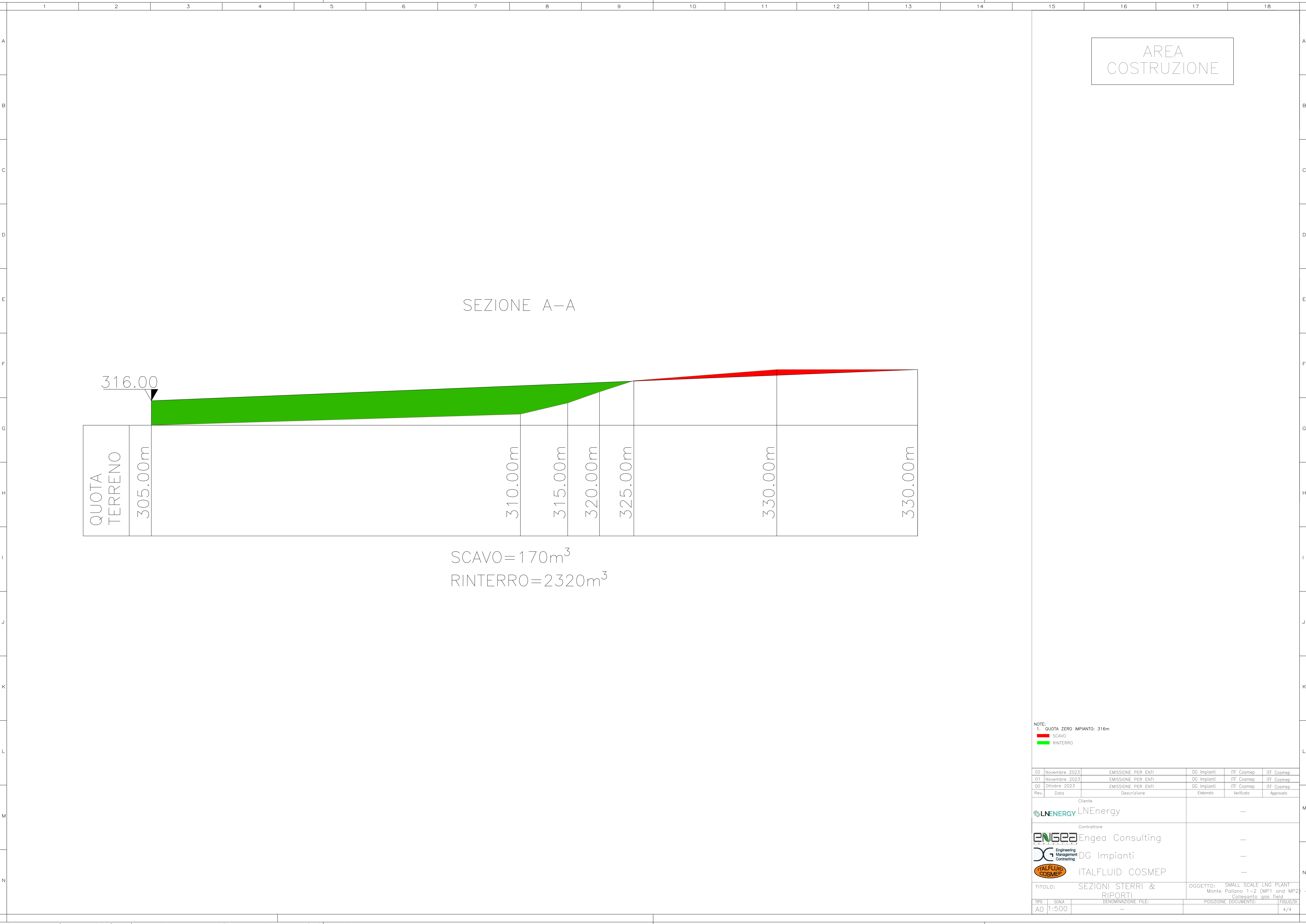
1. QUOTA ZERO IMPIANTO: 316m

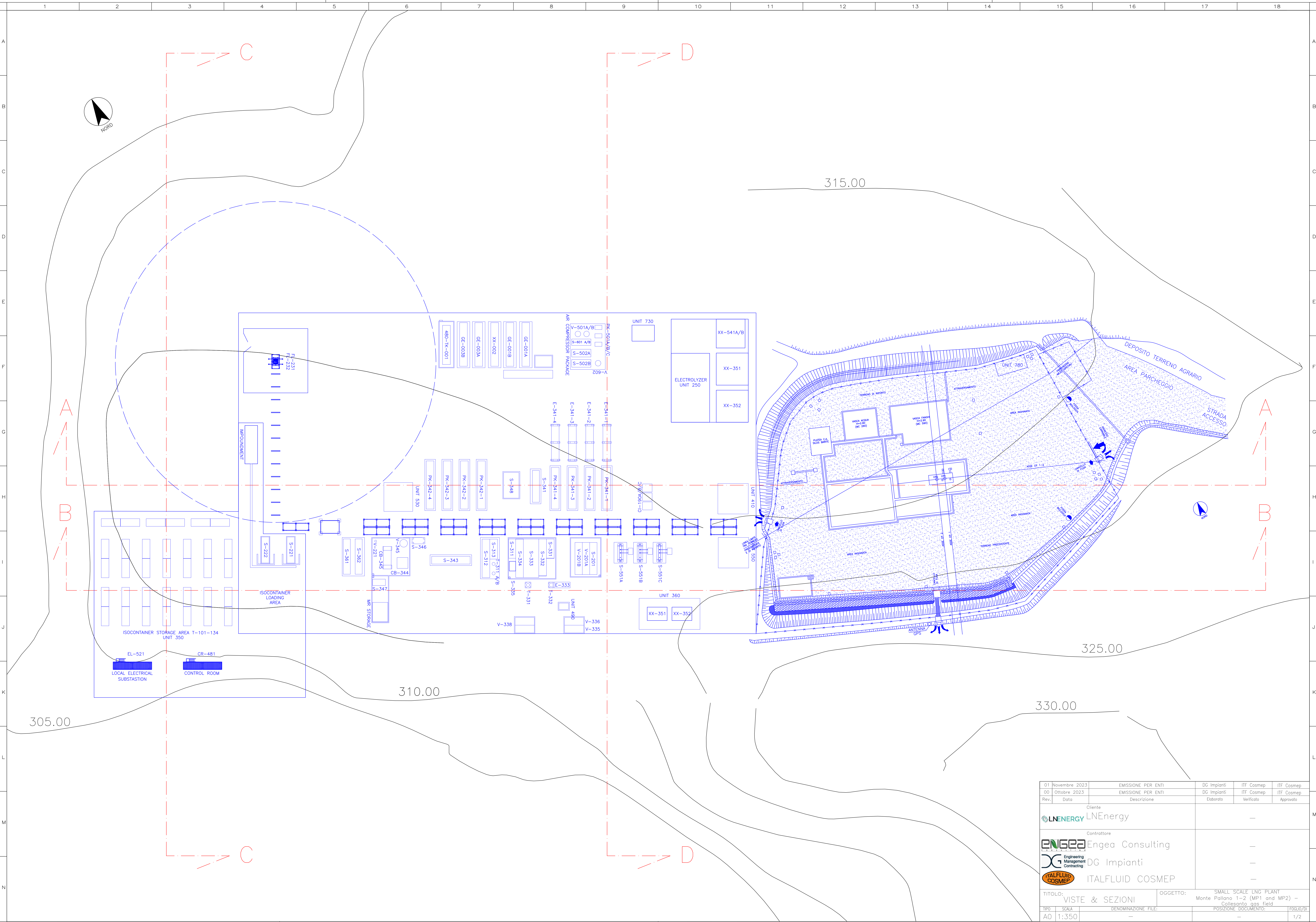
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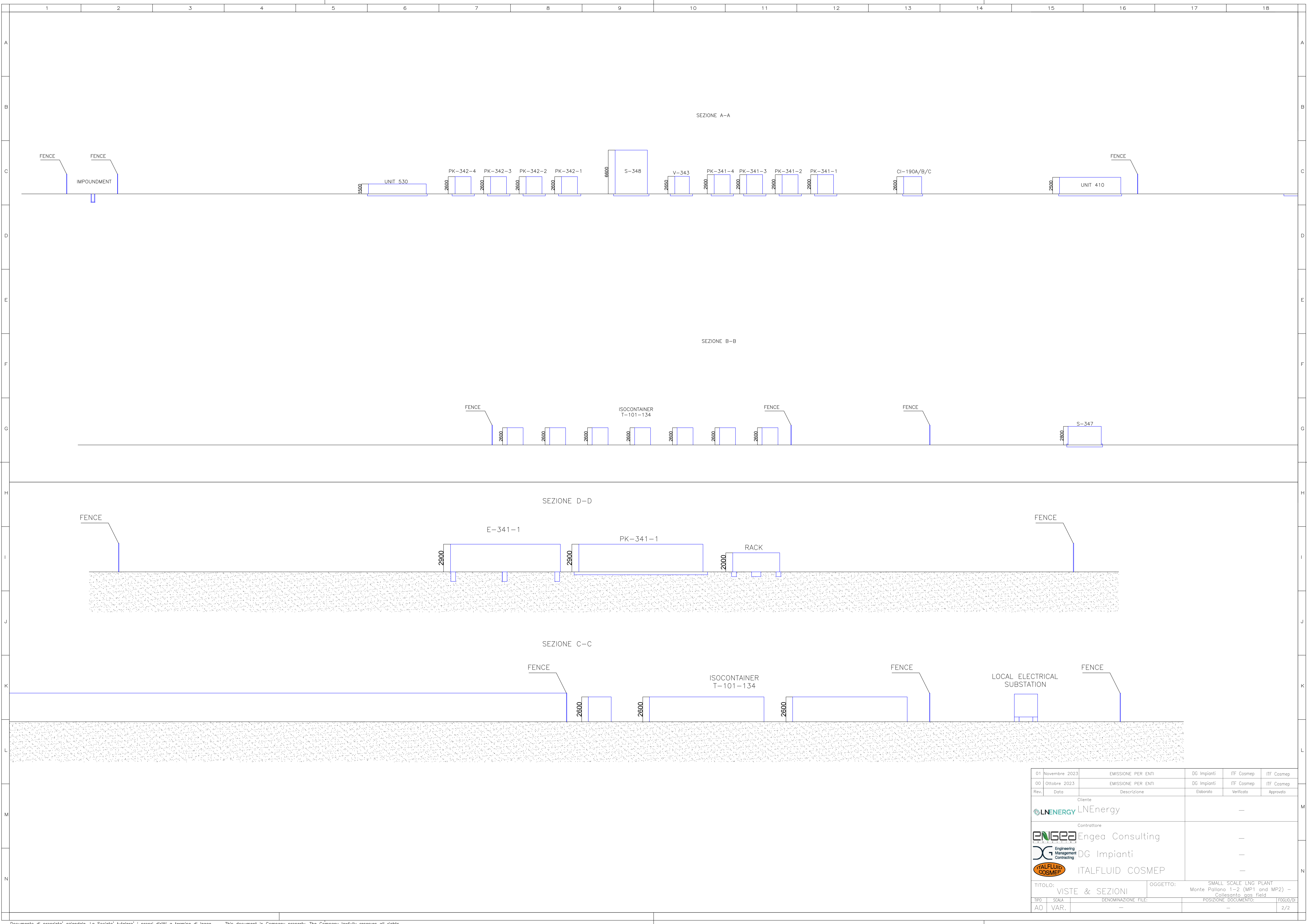
02	Novembre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
01	Novembre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente  LNEnergy			—		
Contrattore  Engea Consulting  DG Impianti  ITALFLUID COSMEP			— — —		
TITOLO: SEZIONI STERRI & RIFORTI			OGGETTO: SMALL SCALE LNG PLANT Monte Pallano 1-2 (MP1 and MP2) Collesanto gas field		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOGLIO/01
AO	1:1000	—			2/4







01	Novembre 2023	EMISSIONE PER ENTI		DC Impianti	ITF Cosmep	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI		DC Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione		Elaborato	Verificato	Approvato
Cliente				—		
 LNEnergy						
Contruttore						
 Engea Consulting				—		
 DG Impianti				—		
 ITALFLUID COSMEP				—		
TITOLO: VISTE & SEZIONI				OGGETTO: SMALL SCALE LNG PLANT Monte Pallano 1-2 (MP1 and MP2) - Collesanto gas field		
TIPO	SCALA	DENOMINAZIONE FILE:		POSIZIONE DOCUMENTO:		FOGLIO/DI
A0	1:350	—		—		1/2



01	Novembre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	Ottobre 2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy					
Contrattore			—		
ENGEA Engea Consulting					
DG Engineering Management Contracting			—		
ITALFLUID COSMEP			—		
TITOLO: VISTE & SEZIONI			OGGETTO: SMALL SCALE LNG PLANT Monte Pallano 1-2 (MP1 and MP2) - Collesanto gas field		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		F0010/01
A0	VAR.	—	—		2/2

QUADRO ECONOMICO

SMALL SCALE LNG PLANT

Colle Santo gas field

-	01	14/12/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
-	00	13/12/2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Status	Rev. n.	Data	Descrizione	Elaborato	Verificato	Approvato
Rev. Index						

Sommario

1. QUADRO ECONOMICO	3
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1. QUADRO ECONOMICO

Nel presente documento si riporta il quadro economico generale inerente il valore complessivo dell'opera privata predisposto secondo la normativa vigente.

Il suddetto quadro economico generale è stato calcolato sulla base del Progetto di Fattibilità dell'opera e di parte della documentazione a corredo del relativo SIA (Studio di Impatto Ambientale).

I documenti specifici redatti per il Progetto di Fattibilità, qui elencati in sintesi, sono la base per la lettura e decodifica delle voci espresse nel quadro economico generale:

- Basi di Progetto
- Bilancio di materia ed energia
- Elenco apparecchiature
- Elenco dei consumi di chimici, materiali consumabili e commodities
- Elenco dei consumi elettrici e fluidi ausiliari di impianto
- Elenco delle emissioni liquide, solide e gassose
- Planimetrie, Viste e Sezioni di Impianto
- Schema a Blocchi Generale
- Schemi di processo

L'investimento complessivo (CAPEX) dedicato al nuovo progetto di sviluppo del campo di Colle Santo, denominato "SMALL SCALE LNG", è pari a **66 milioni di Euro**, al netto di IVA e oneri di legge.

Il quadro economico ricomprende le attività di cantiere e di costruzione dell'impianto SMALL SCALE LNG, incluse le opere di mitigazione, le opere connesse e le spese generali. Non vengono chiaramente ricompresi i costi e gli oneri relativi alla fase di esercizio dell'impianto SMALL SCALE LNG.

Per quanto riguarda, infine, la fase di dismissione dell'impianto SMALL SCALE LNG e ripristino ambientale, realizzata al termine della produzione dei pozzi MP1, MP2, e che prevede la chiusura mineraria preliminare degli stessi pozzi, in questa fase non è stata ricompresa nel presente quadro economico generale in quanto ad oggi, vista la durata del periodo di produzione (ca 20 anni), non è possibile prevedere con quale tipologia di impianto e tecnologia verrà effettuata la suddetta chiusura mineraria e, pertanto, non sono quantificabili gli importi economici. Le attività di chiusura mineraria saranno comunque oggetto di un separato e specifico iter autorizzativo ambientale.

QUADRO ECONOMICO GENERALE Valore complessivo dell'opera privata			
DESCRIZIONE	IMPORTI IN €	IVA % Nota (1)	TOTALE € (IVA compresa)
A) COSTO DEI LAVORI			
A.1) Interventi previsti	40.000.000,00	8.800.000,00	48.800.000,00
A.2) Oneri di sicurezza	1.200.000,00	-	1.200.000,00
A.3) Opere di mitigazione	5.000.000,00	1.100.000,00	6.100.000,00
A.4) Spese previste da Studio di Impatto Ambientale, Studio Preliminare Ambientale e Progetto di Monitoraggio Ambientale	7.000.000,00	1.540.000,00	8.540.000,00
A.5) Opere connesse (infrastrutture esterne alla recinzione di impianto, viabilità accessoria all'impianto e installazioni per ausiliari all'impianto)	3.100.000,00	682.000,00	3.782.000,00
TOTALE A	56.300.000,00	12.122.000,00	68.422.000,00
B) SPESE GENERALI			
B.1 Spese tecniche relative alla progettazione, ivi inclusa la redazione dello studio di impatto ambientale o dello studio preliminare ambientale e del progetto di monitoraggio ambientale, alle necessarie attività preliminari, al coordinamento della sicurezza in fase di progettazione, alle conferenze di servizi, alla direzione lavori e al coordinamento della sicurezza in fase di esecuzione, all'assistenza giornaliera e contabilità	6.000.000,00	1.320.000,00	7.320.000,00
B.2) Spese consulenza e supporto tecnico	600.000,00	132.000,00	732.000,00
B.3) Collaudo tecnico e amministrativo, collaudo statico ed altri eventuali collaudi specialistici	400.000,00	88.000,00	488.000,00
B.4) Spese per Rilievi, accertamenti, prove di laboratorio, indagini (includere le spese per le attività di monitoraggio ambientale)	600.000,00	132.000,00	732.000,00
B.5) Oneri di legge su spese tecniche B.1), B.2), B.4) e collaudi B.3)	304.000,00	-	304.000,00
B.6) Imprevisti	1.276.000,00	280.720,00	1.556.720,00
B.7) Spese varie	520.000,00	114.400,00	634.400,00
TOTALE B	9.700.000,00	2.067.120,00	11.767.120,00
C) eventuali altre imposte e contributi dovuti per legge (...specificare) oppure indicazione della disposizione relativa l'eventuale esonero.	Nota (2)	Nota (2)	Nota (2)
"Valore complessivo dell'opera" TOTALE (A + B + C)	66.000.000,00	14.189.120,00	80.189.120,00

Nota (1): Importo previsionale sulla base della tassazione corrente da verificare nella successiva fase di ingegneria di dettaglio e in sede di appalto dell'opera privata ai contraffattori/professionisti/imprese coinvolte dal Proponente

Nota (2): Eventuali altre imposte e contributi dovuti per legge non sono in questa fase definibili e si rimanda alla successiva fase di ingegneria di dettaglio, fasi di appalto dell'opera privata e fasi conclusive di messa in esercizio dell'impianto SMALL SCALE LNG.

CONFIDENZIALE

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

NOTE:

- Volume flush drum a monte pompe di carico ~22 m³;
- Baia di carico per Isotank da 20 m³ – 14 Isotank caricati al giorno;
- Da utilizzare come rimbocco o durante le fasi di avviamento.
- Scarico che può essere convogliato a sistema di cattura e recupero della CO₂.
- Come da D.Lgs 152_2006
- Incluso camino di by-pass con pilota, in grado di assicurare una efficienza minima di combustione del 99% espressa come CO₂/(CO₂+CO)

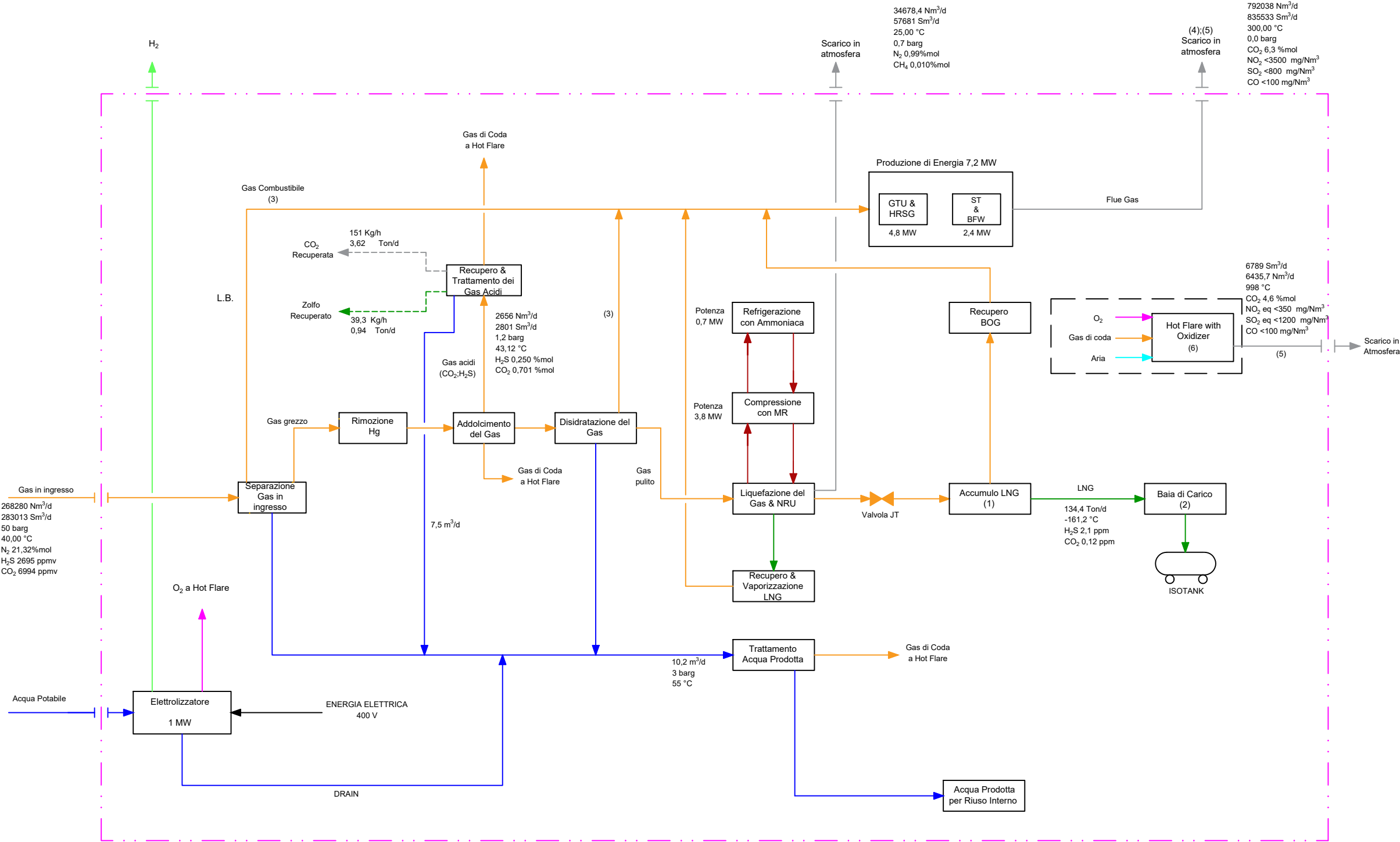
LISTA ACRONIMI:

- Hg: Mercurio
- RPB: Recupero, Purificazione e Imbottigliamento
- NRU: Unità Rimozione Azoto
- LNG: Gas Naturale Liquefatto
- BOG: Gas di bilanciamento
- L.B.: Limiti di Impianto
- GTU: Turbina a Gas
- HRST: Recupero Termico e Turbina a Vapore
- BFW: Acqua Alimento Caldaia

LISTA FLUIDI

- GAS
- ACQUA
- CONDENSATI
- REFRIGERANTI
- CO₂, NO₂, FUMI
- H₂
- O₂

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO:		
SMALL SCALE LNG PLANT			SCHEMA A BLOCCHI GENERALE		
Collesanto gas field			POSIZIONE DOCUMENTO:		
TIPO	SCALA	DENOMINAZIONE FILE:	FOGLIO/OT		
A1	X:XXX	—	1/1		



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

Note:

- (1) LINEA DI REINTEGRO DEL GAS COMBUSTIBILE, UTILIZZATO ANCHE PER CONSENTIRE L'AVVIO INDIPENDENTE DELLA PRODUZIONE DI ENERGIA.
- (2) CONTROLLO DEL NUOVO LIQUIDO UTILIZZATO SOLO PER L'AVVIAMENTO. DOPO L'AVVIAMENTO LA VALVOLA MANUALE DEVE ESSERE BLOCCATA CHIUSA.

LEGENDA:

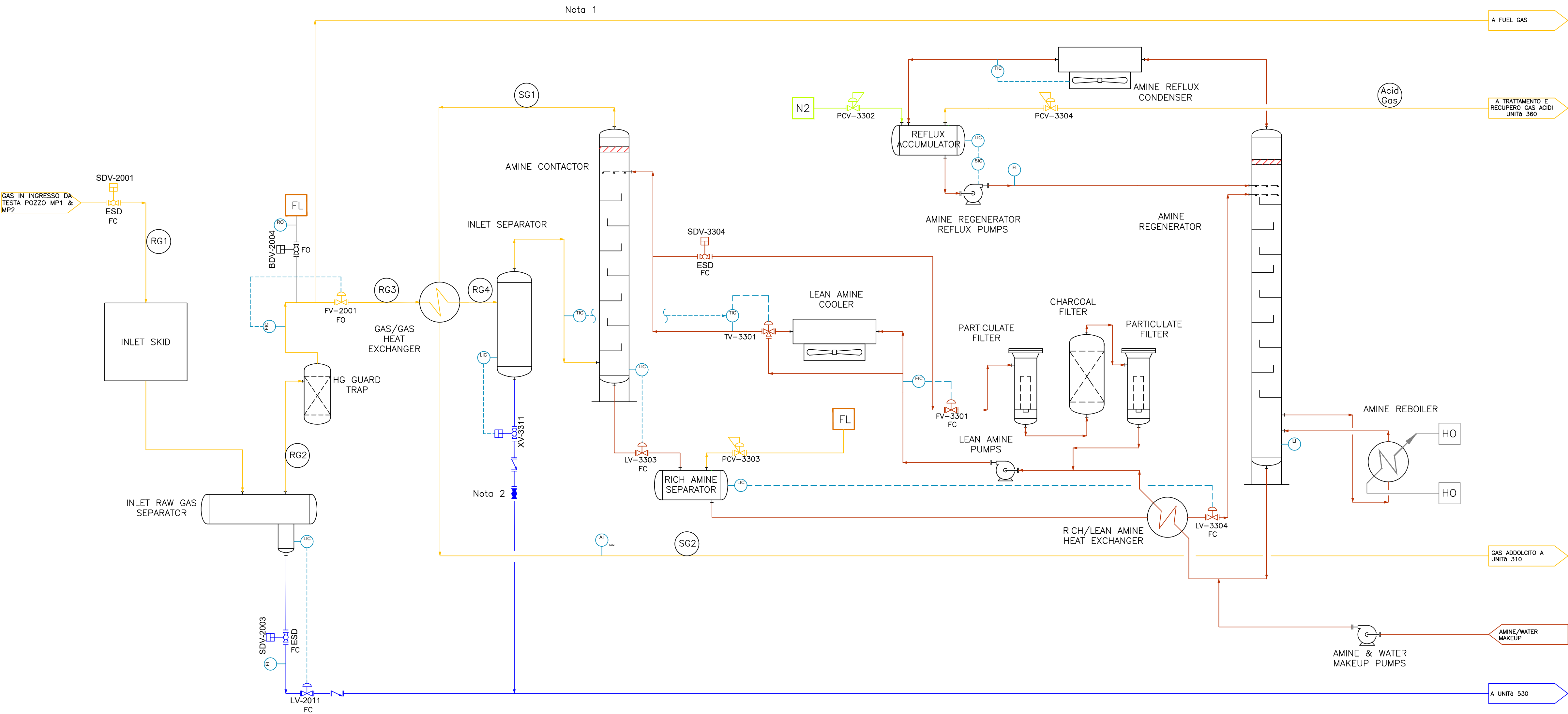
- HO HOT OIL
- FL SISTEMA COLD FLARE
- N2 AZOTO

LISTA FLUIDI

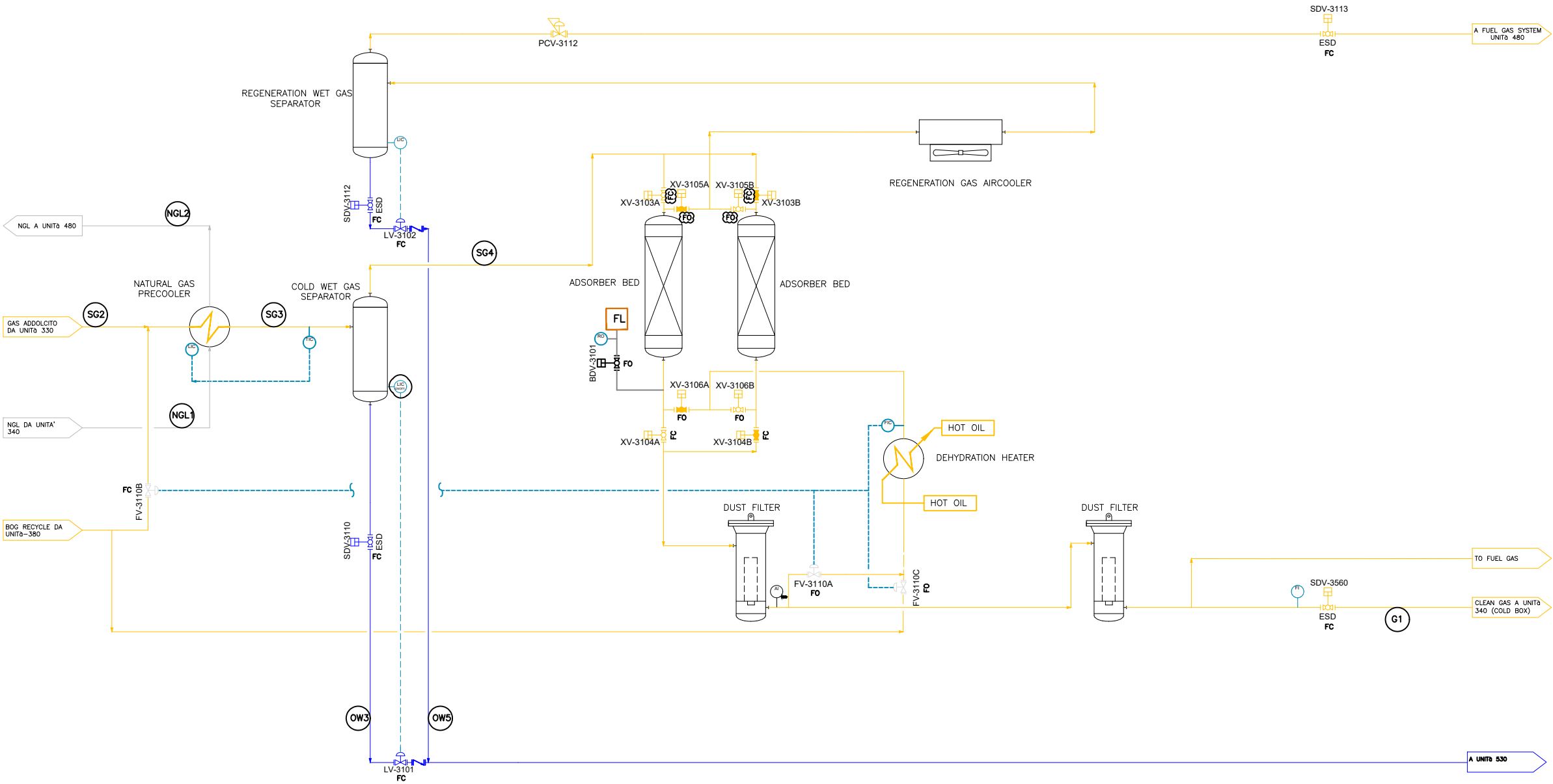
- | | |
|-------------------|---------------------------------|
| CONDENSATI | PSV |
| GAS | REFRIGERANTE (AMMONIACA) |
| ACQUA DI PROCESSO | LINEA STRUMENTALE |
| AMMONIACA | DIESEL |
| HOT OIL | GAS INERTE |
| LNG | MR REFRIGERANTE MULTICOMPONENTE |

01	13-11-2023	REVISIONATO DOVE INDICATO	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Engineering Management Contracting			—		
ITALFLUID COSMEP			—		
TITOLO: SMALL SCALE LNG PLANT Collesanto gas field			OGGETTO: SCHEMA DI PROCESSO - INGRESSO E ADDOLCIMENTO GAS (Unità 200 & 330)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOLIO/DI
A0	XX	—	PFD 1		1/1

UNITA' 200 & 330



UNITA' 310



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

LEGENDA:

FL COLD FLARE SYSTEM

LISTA FLUIDI

CONDENSATI	PSV
GAS	REFRIGERANTE (AMMONIACA)
ACQUA DI PROCESSO	LINEA STRUMENTALE
AMMONIACA	DIESEL
HOT OIL	GAS INERTE
LNG	MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - DISIDRATAZIONE DEL GAS (Unità 310)		
TITOLO:			DISIDRATAZIONE DEL GAS (Unità 310)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOLIO/01
A0	XX	—	PFD 2		1/1

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

LEGENDA:

MR MR REFRIGERANTE MULTICOMPONENTE

LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy					
Contrattore			—		
ENGEA Engea Consulting					
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO: SMALL SCALE LNG PLANT Collesanto gas field			OGGETTO: SCHEMA DI PROCESSO – LIQUEFAZIONE DEL GAS (Lato Processo) (Unità 340)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:	FOGLIO/01	
A0	XX	—	PFD 3	1/1	

CONFIDENZIALE

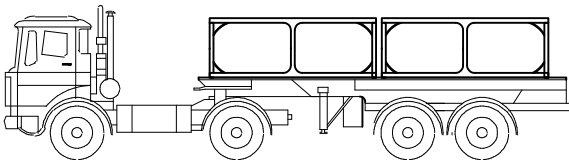
NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

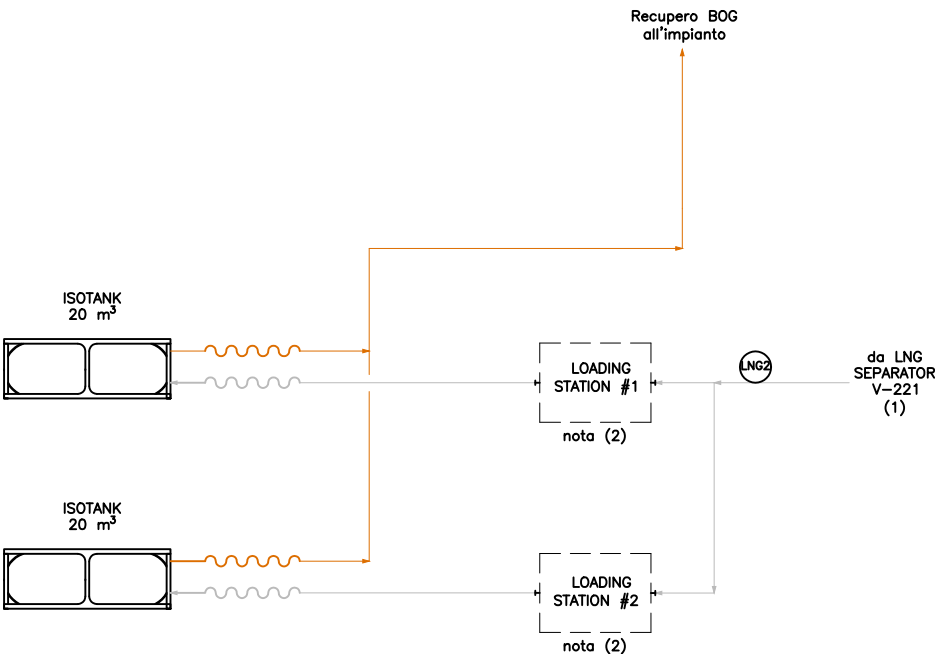
NOTE:

- (1) Volume flush drum a monte pompe di carico ~22 m³;
- (2) Baia di carico per Isotank da 20 m³ – 14 Isotank caricati al giorno;
- (3) Caricamento di 2 ISOTANK al giorno su ciascun bilico ribassato per un totale di 7 viaggi al giorno con bilico ribassato

UNITA' 220



nota (3)



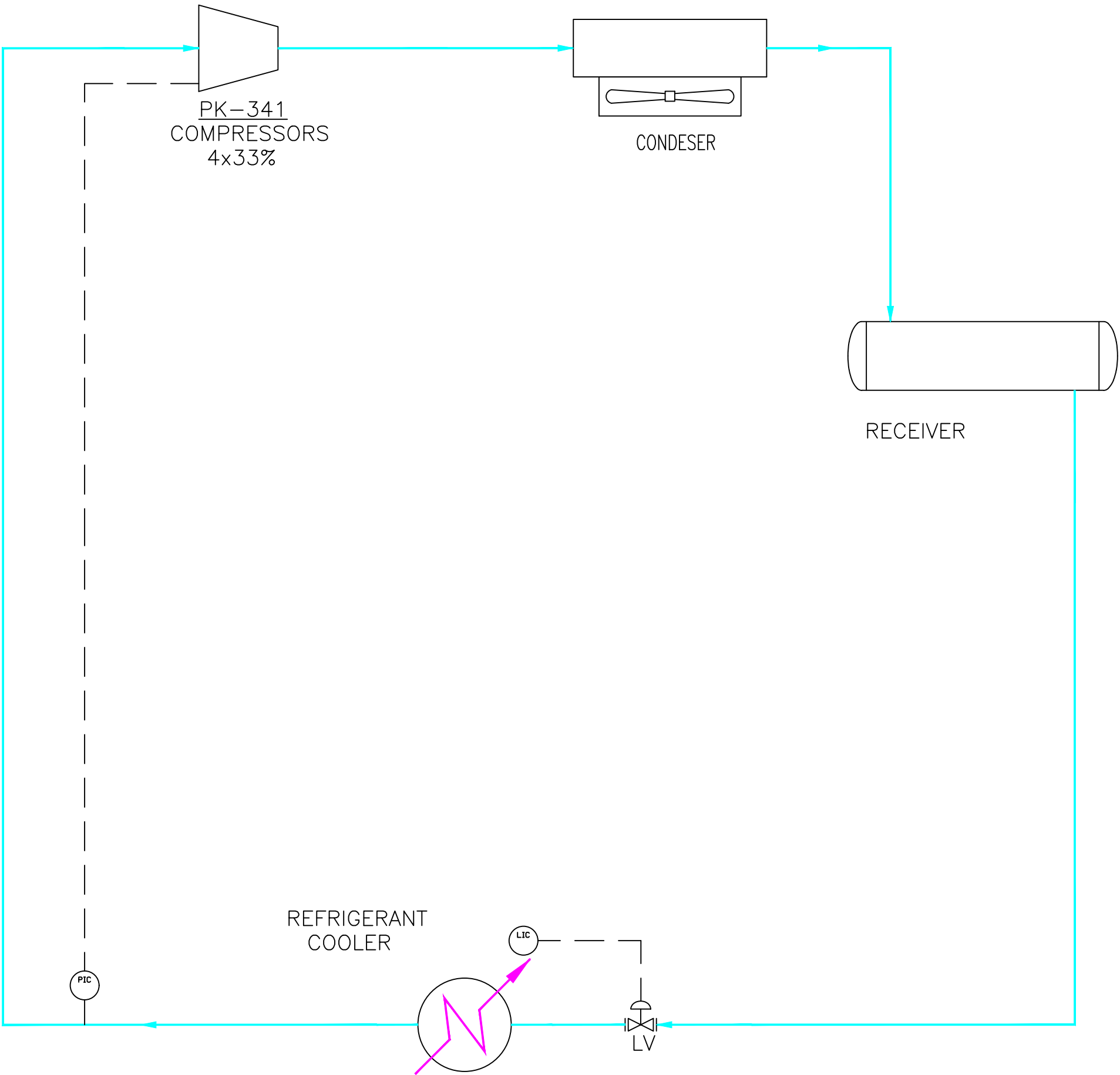
LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
LNEnergy			-		
Contrattore					
Engea Consulting			-		
DG Impianti			-		
ITALFLUID COSMEP			-		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - CARICAMENTO LNG (Unità 220)		
SMALL SCALE LNG PLANT Collesanto gas field					
TPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOLIO/OT
A0	XX	-	PFD 4		1/1

Unità 340

CONFIDENZIALE



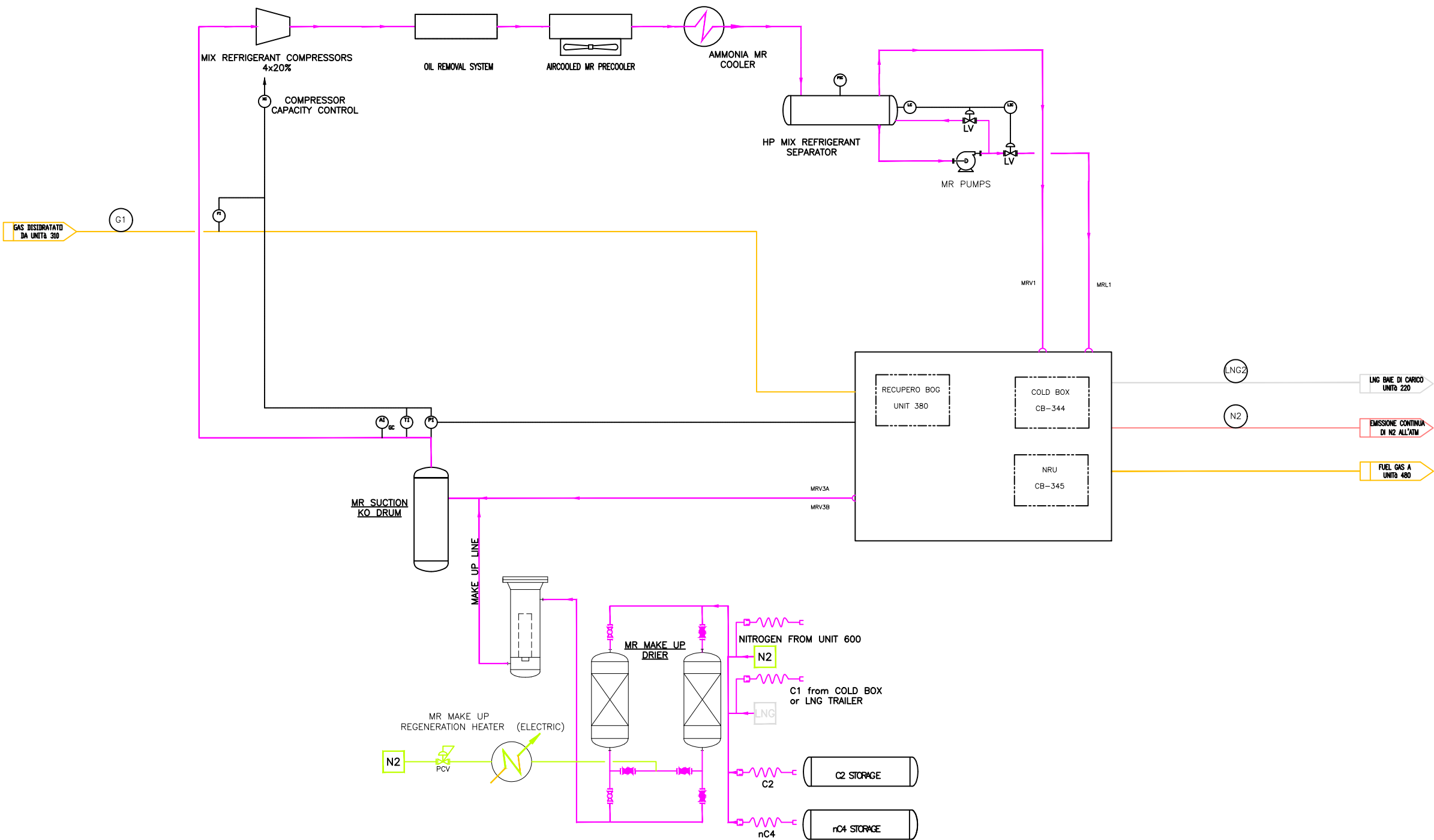
NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
LNEnergy			-		
Contrattore					
Engea Consulting			-		
DG Impianti			-		
ITALFLUID COSMEP			-		
TITOLO: SMALL SCALE LNG PLANT Collesanto gas field			OGGETTO: SCHEMA DI PROCESSO - REFRIGERAZIONE CON AMMONIACA (Unità 340)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:	FOGLIO/01	
A0	XX	-	PFD 5	1/1	



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

LEGENDA:

- N2

AZOTO
- LNG

GAS NATURALE LIQUEFATTO

LISTA FLUIDI

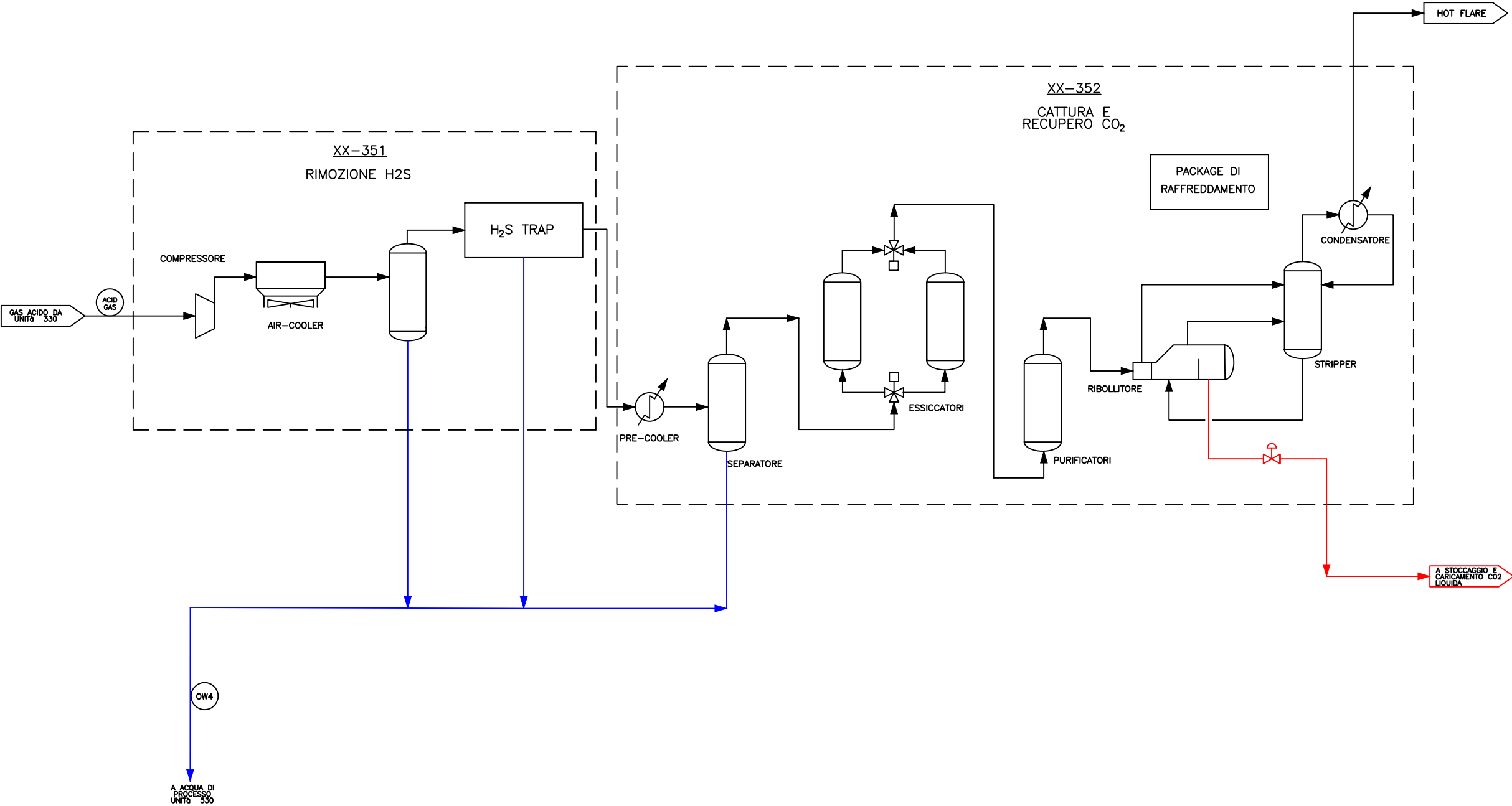
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|-------------------------------|---|
| <div></div> CONDENSATI | <div></div> PSV |
| <div></div> GAS | <div></div> REFRIGERANTE (AMMONIACA) |
| <div></div> ACQUA DI PROCESSO | <div></div> LINEA STRUMENTALE |
| <div></div> AMMONIACA | <div></div> DIESEL |
| <div></div> HOT OIL | <div></div> GAS INERTE |
| <div></div> LNG | <div></div> MR REFRIGERANTE MULTICOMPONENTE |
| <div></div> O ₂ | <div></div> MR REFRIGERANTE MULTICOMPONENTE |

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY					
Contrattore					
ENGEA			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - LIQUEFAZIONE DEL GAS (Lato Refrigerante) (Unità 340)		
TPO			POSIZIONE DOCUMENTO:		
A0	XX	—	PFD 6		1/1

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

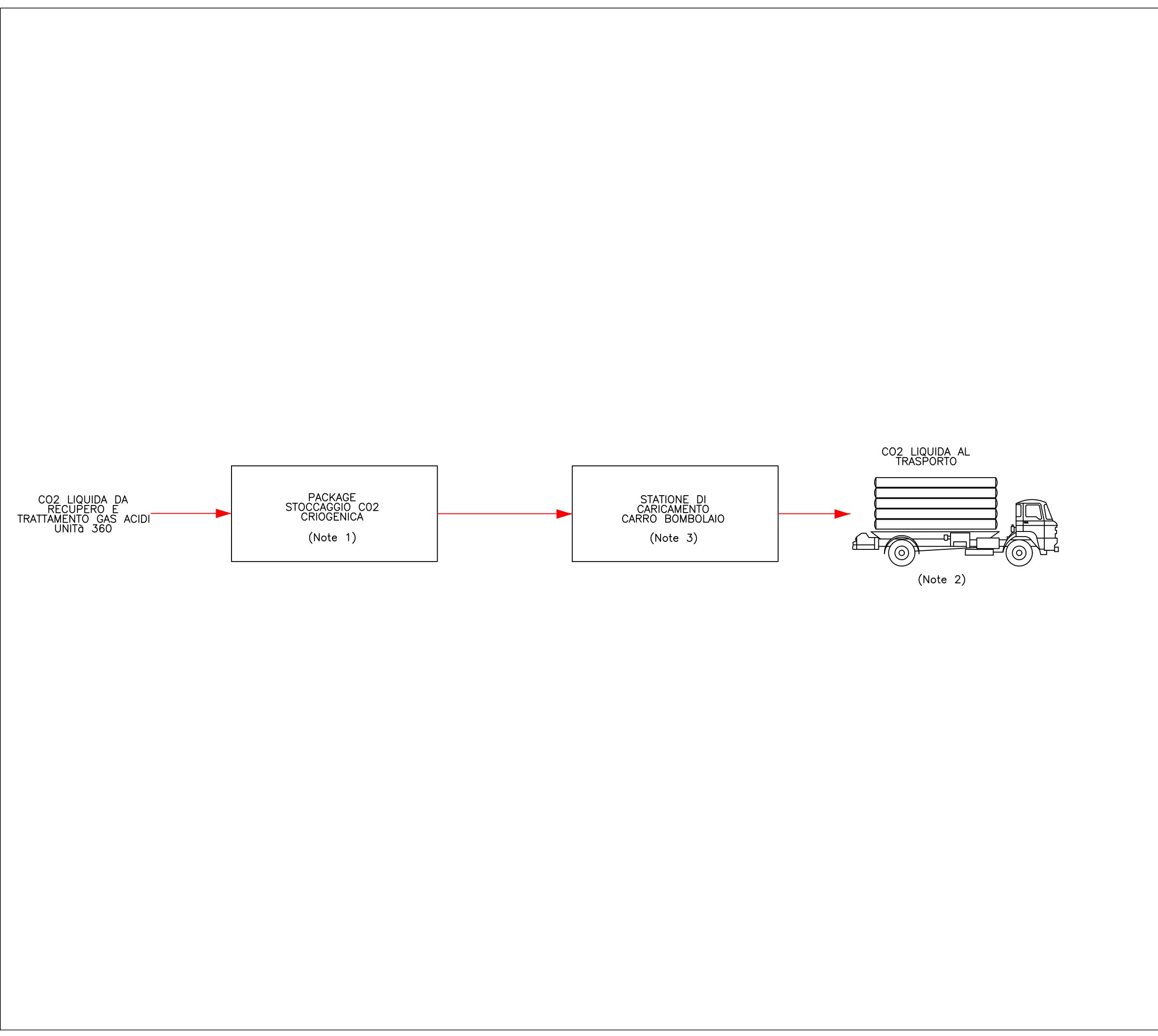
UNITA' 360



LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE
	O2		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO: SMALL SCALE LNG PLANT Collesanto gas field			OGGETTO: SCHEMA DI PROCESSO - TRATTAMENTO E RECUPERO GAS ACIDI (Unità 360)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:	FOGLIO/01	
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CONFIDENZIALE

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

NOTE:

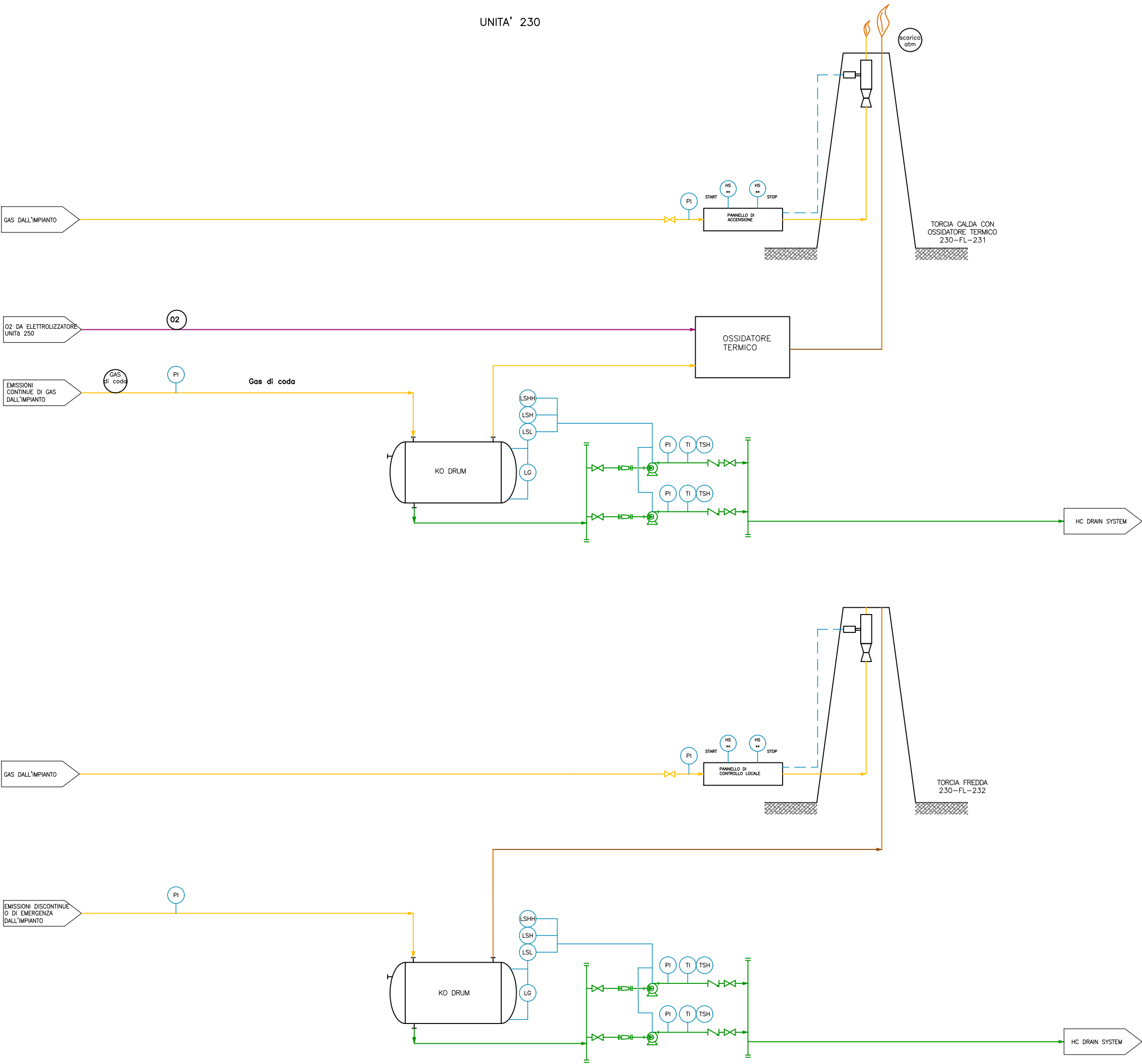
- (1) Capacità CO2 liquida pari a 10.000 litri corrispondente a circa 2/3 giorni di Hold-up;
- (2) Carichi previsti pari a 1 ogni 5 giorni (volume cisterna pari a 20 m³)
- (3) Analizzatori per la CO2 liquida prodotta inclusi nella stazione di caricamento

LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE
	O ₂		CO ₂

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
 LNEnergy			—		
Contrattore					
 Engea Consulting			—		
 DG Impianti			—		
 ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO -		
SMALL SCALE LNG PLANT			STOCCAGGIO E CARICAMENTO CO ₂ LIQUIDA		
Collesanto gas field					
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOLIO/OT
A0	XX	—	PFD 8		1/1

UNITA' 230



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE
	O ₂		

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY					
Contrattore			—		
ENGEA Engea Consulting					
DG Impianti					
ITALFLUID COSMEP					
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - SISTEMI DI TORCIA (Unità 230)		
SMALL SCALE LNG PLANT Collesanto gas field			POSIZIONE DOCUMENTO:		
TPO	SCALA	DENOMINAZIONE FILE:			Foglio/01
A0	XX	—	PFD 9		1/1

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

NOTE:

(1) Flusso discontinuo

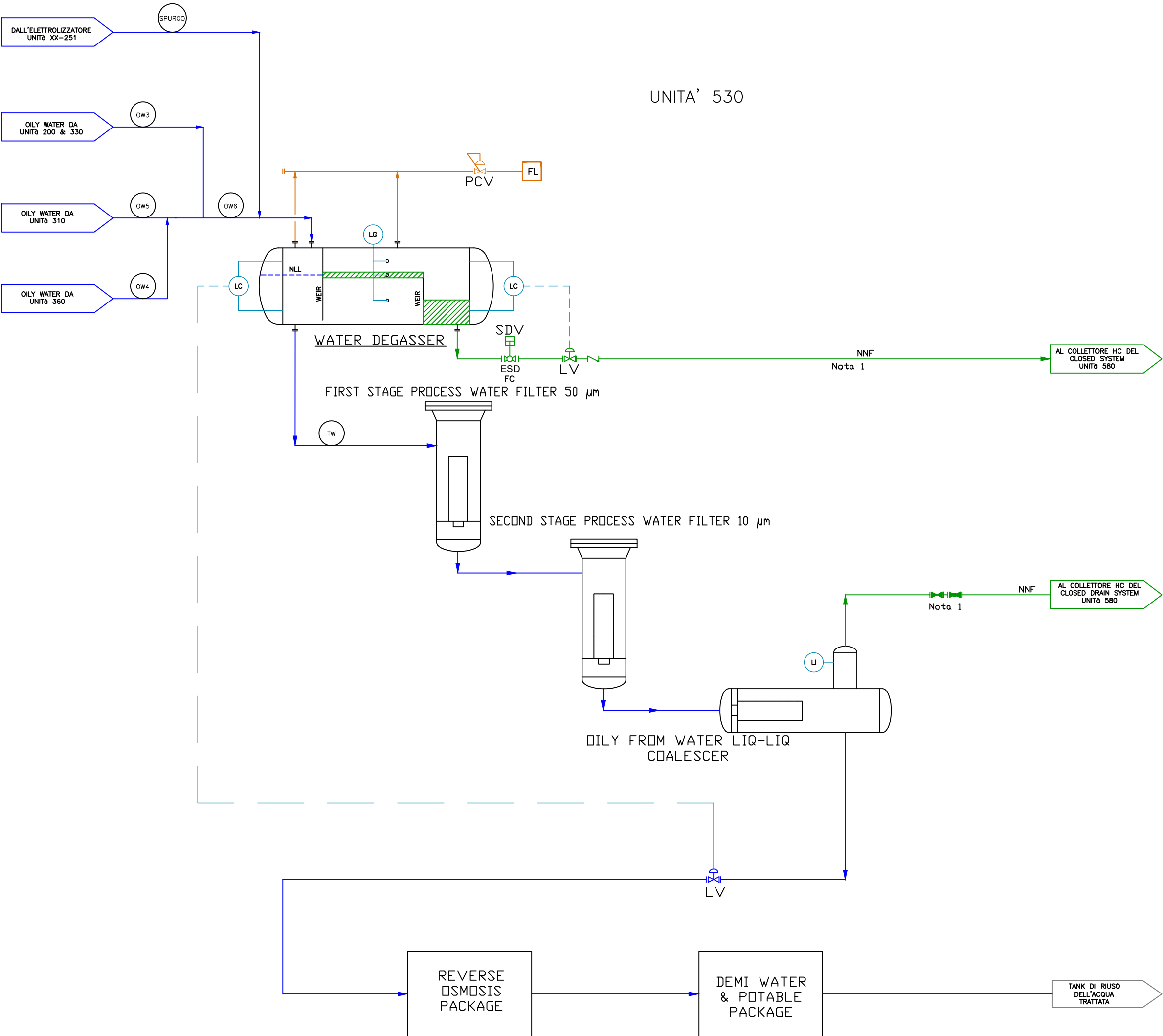
LEGENDA:

FL COLD FLARE SYSTEM

LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

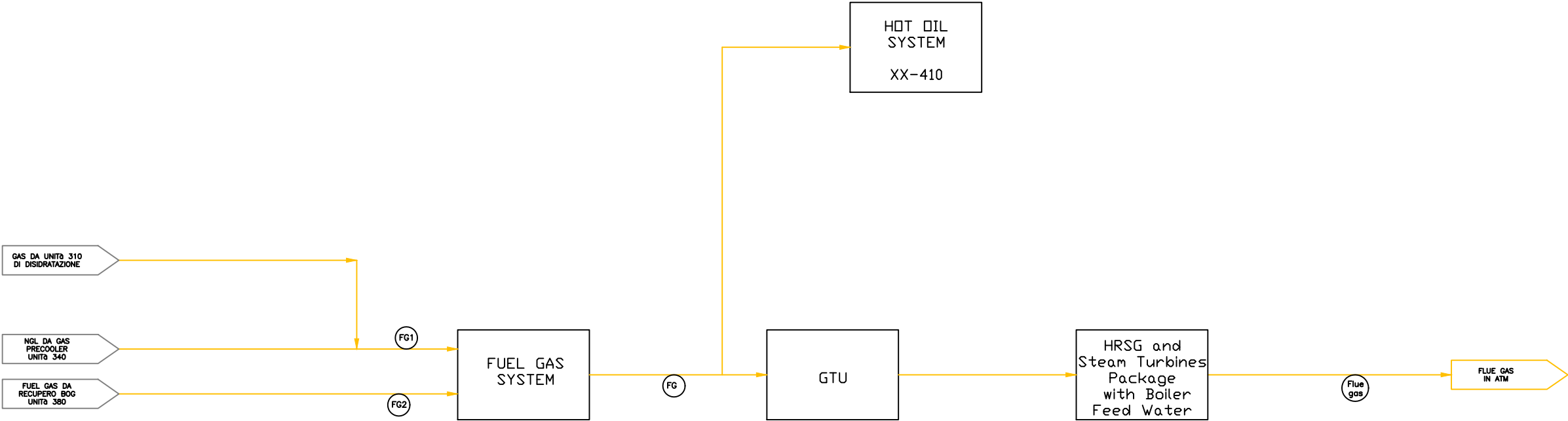
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00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			-		
LNENERGY			-		
Contrattore			-		
ENGEA Engea Consulting			-		
DG Impianti			-		
ITALFLUID COSMEP			-		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - TRATTAMENTO ACQUA (unità 530)		
TITOLO:			POSIZIONE DOCUMENTO:		
TIPO	SCALA	DENOMINAZIONE FILE:	PFD 10		1/1
A0	XX	-			



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

UNITA' 480



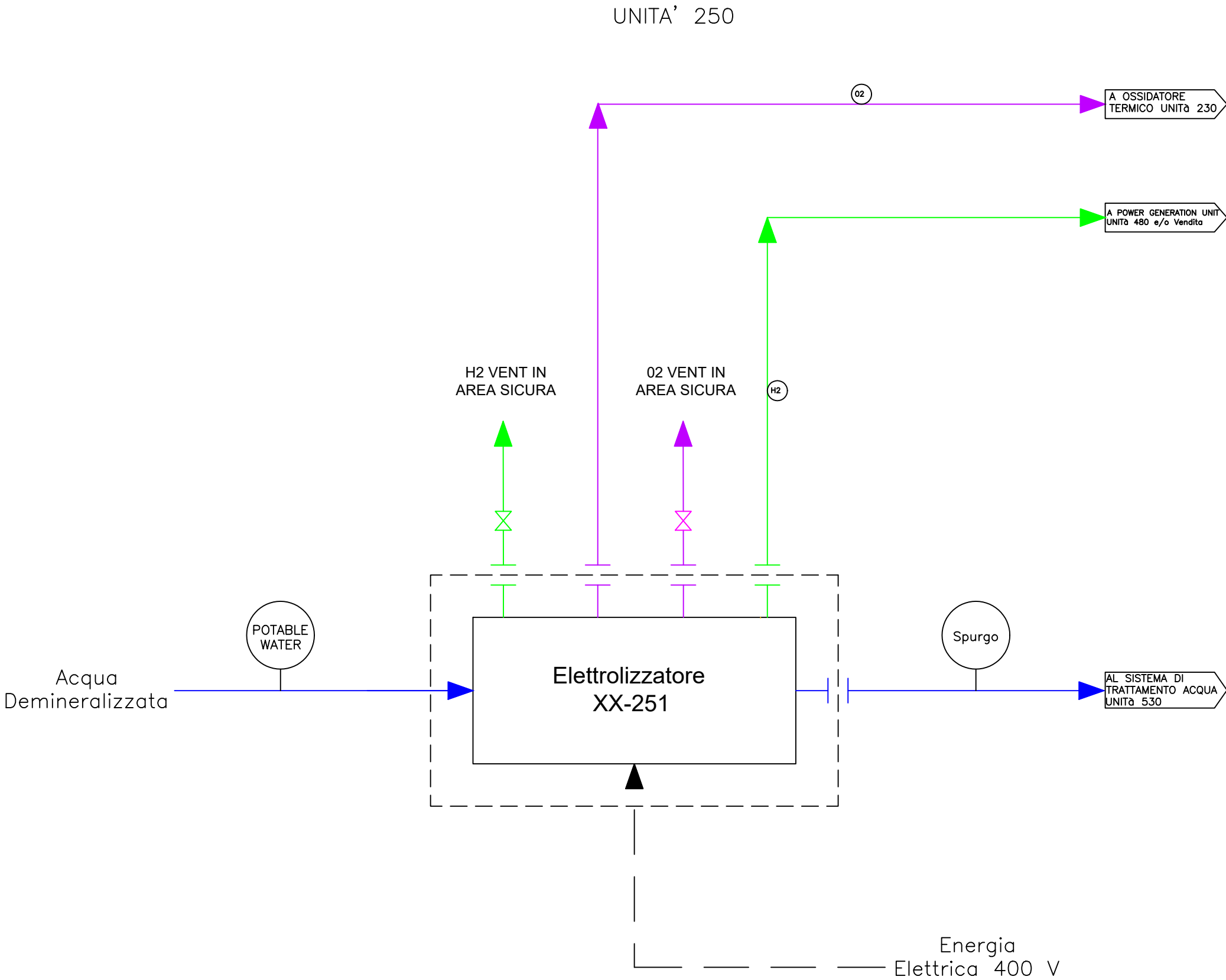
LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
LNEnergy			—		
Contrattore					
Engea Consulting			—		
Engineering Management Contracting DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO –		
SMALL SCALE LNG PLANT			PRODUZIONE DI ENERGIA ELETTRICA		
Collesanto gas field			E RECUPERO DI VAPORE (Unità 480)		
DENOMINAZIONE FILE:			POSIZIONE DOCUMENTO:		
TP0	SCALA		PFD 11	1/1	
A0	XX	—			

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore
- H2 prodotto ricircolato al blocco GTU per migliorare le prestazioni della Turbina elettrica ancorchè essere destinato a vendita/fornitura utilizzatore come commodities



LISTA FLUIDI

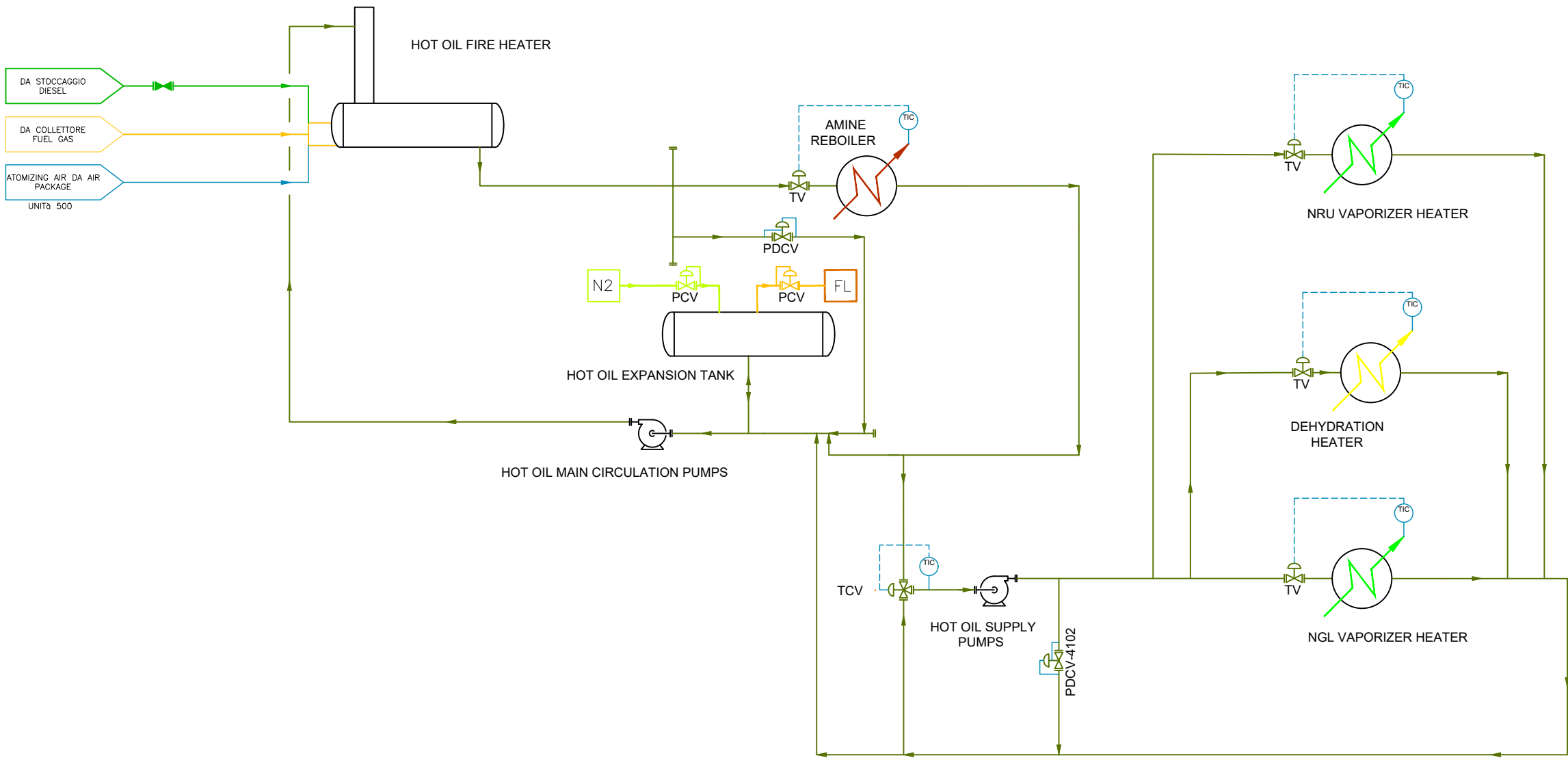
CONDENSATI	PSV
GAS	REFRIGERANTE (AMMONIACA)
ACQUA DI PROCESSO	LINEA STRUMENTALE
AMMONIACA	DIESEL
HOT OIL	GAS INERTE
LNG	MR REFRIGERANTE MULTICOMPONENTE
H2	O2

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY			—		
Contrattore			—		
ENGEA			—		
Engineering Management Contracting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO —		
SMALL SCALE LNG PLANT			ELETTROLIZZATORE (Unità 250)		
Colesanto gas field			—		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		PAGINA/DI
A0	XX	—	PFD 12		1/1

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

UNITA' 410



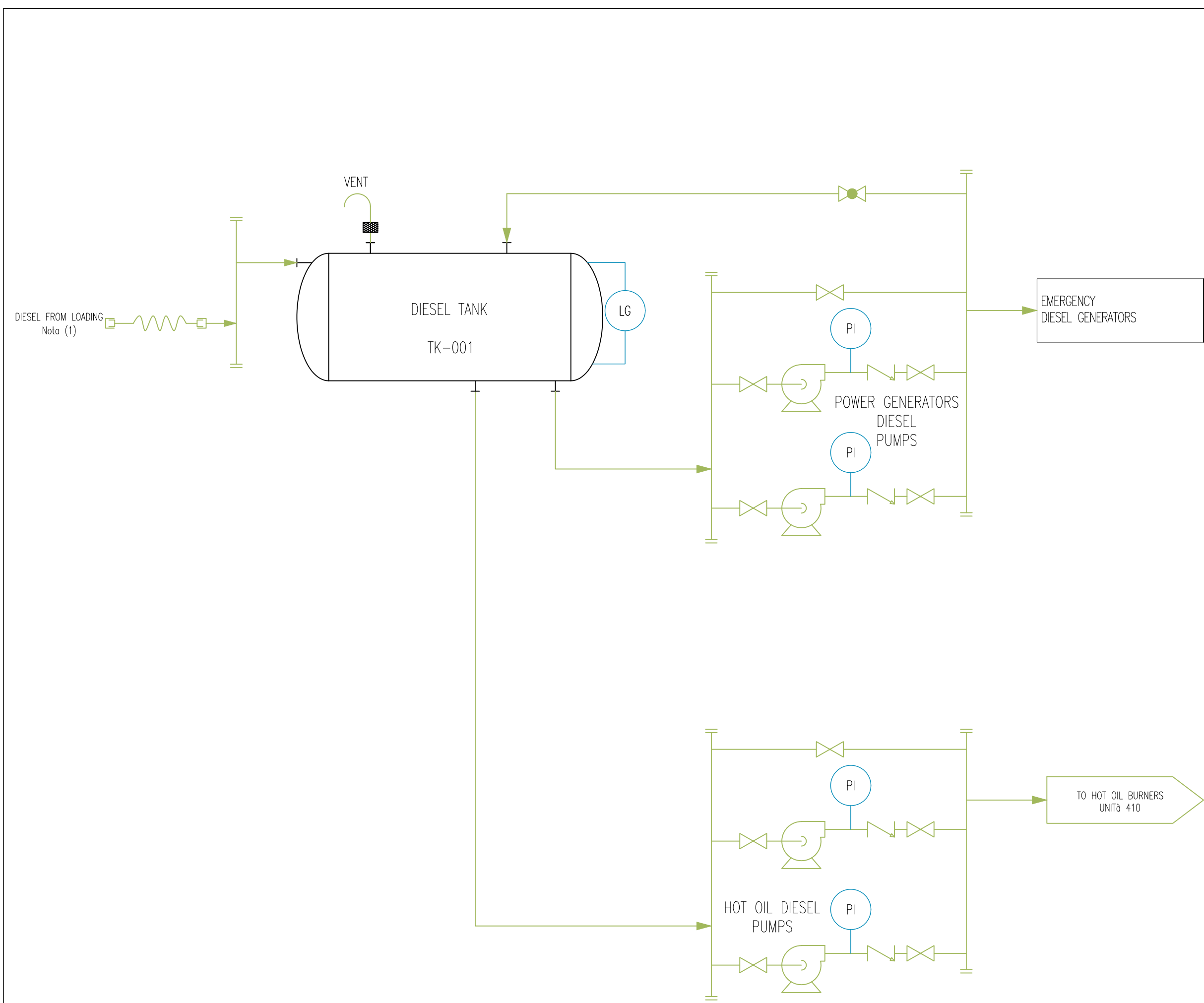
LEGENDA:

- FL COLD FLARE SYSTEM
- N2 AZOTO

LISTA FLUIDI

CONDENSATI	PSV
GAS	REFRIGERANTE (AMMONIACA)
ACQUA DI PROCESSO	LINEA STRUMENTALE
AMMONIACA	DIESEL
HOT OIL	GAS INERTE
LNG	MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO — HOT OIL (Unità 410)		
SMALL SCALE LNG PLANT Collesanto gas field			POSIZIONE DOCUMENTO: PFD 13		
TIPO	SCALA	DENOMINAZIONE FILE:	FOGLIO/01		
A0	XX	—	1/1		



CONFIDENZIALE

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore
- Diesel usato solo per emergenza e avviamento dell'impianto, caricato da cisterna.

LISTA FLUIDI

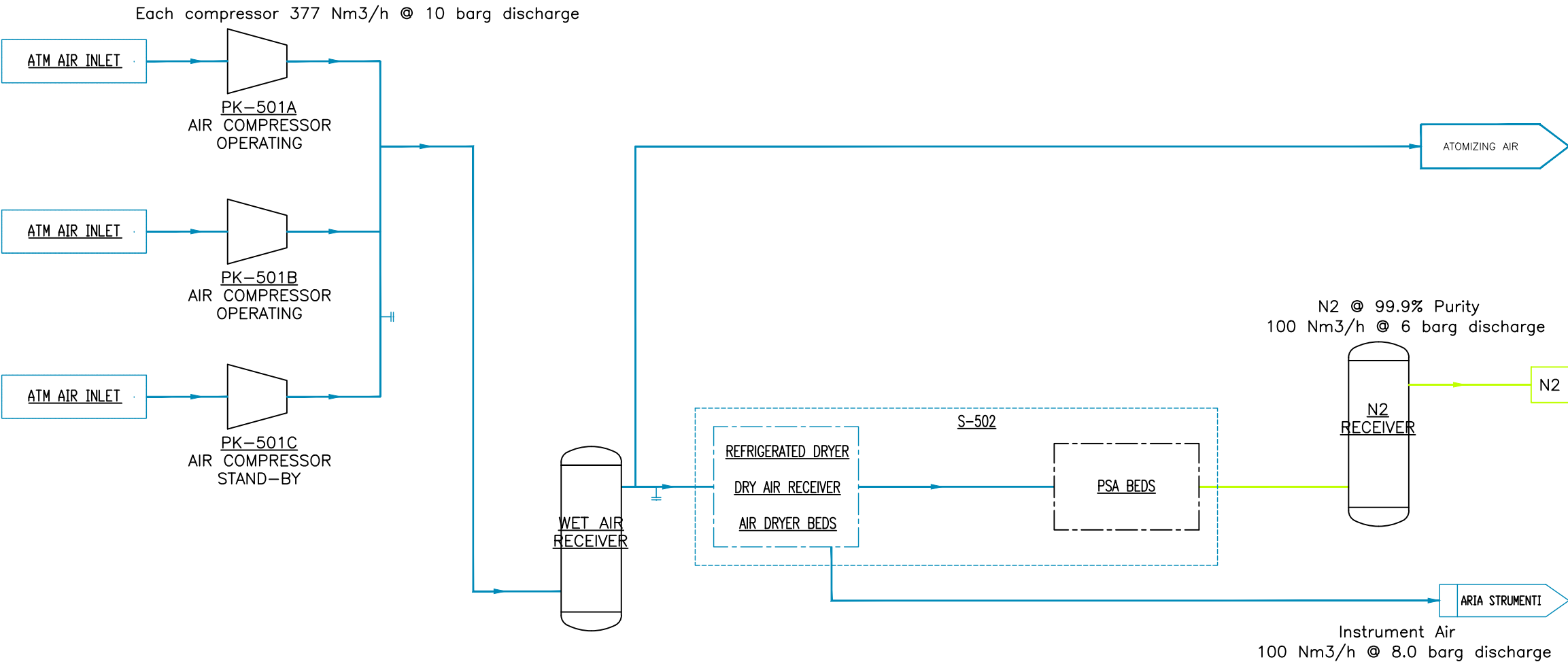
	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
 LNEnergy			-		
Contrattore					
 Engea Consulting			-		
 DG Impianti			-		
 ITALFLUID COSMEP			-		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO -		
SMALL SCALE LNG PLANT			UNITà DIESEL (Solo per Start-up)		
Collesanto gas field			(Unità 480)		
TPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:	FOGLIO/01	
A0	XX	-	PFD 14	1/1	

NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

UNITA' 500



LEGENDA:

N2 AZOTO

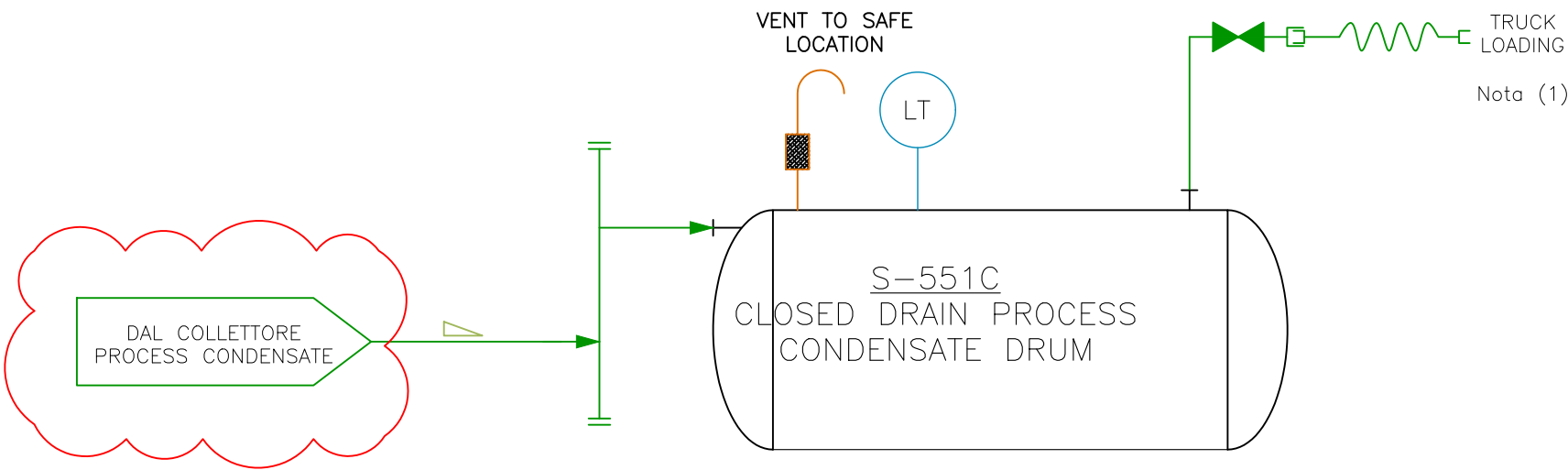
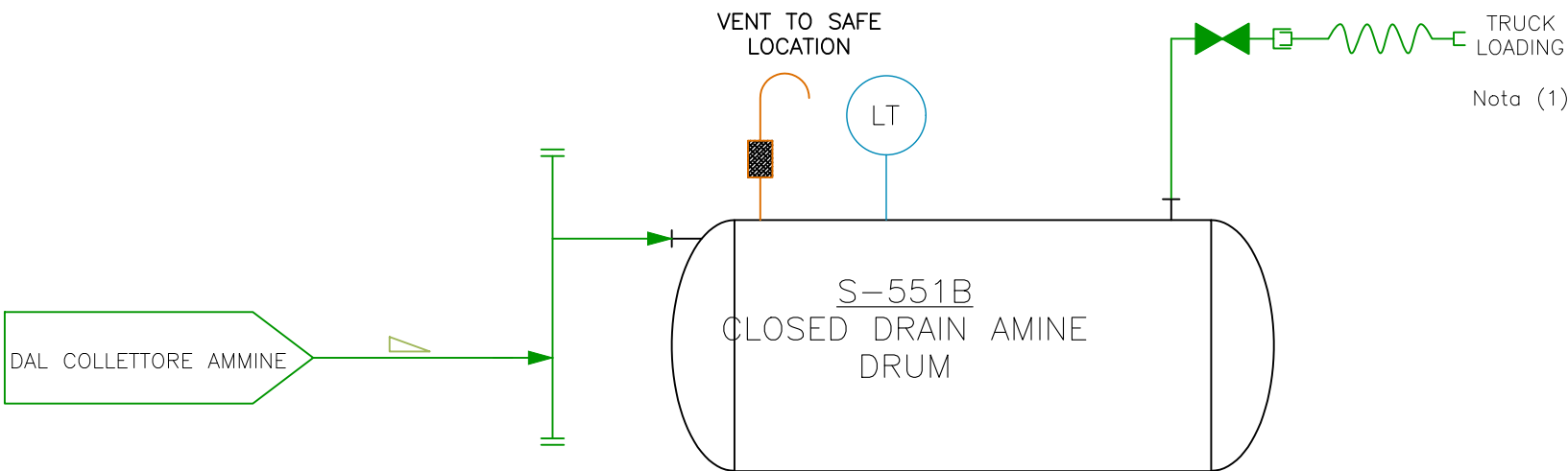
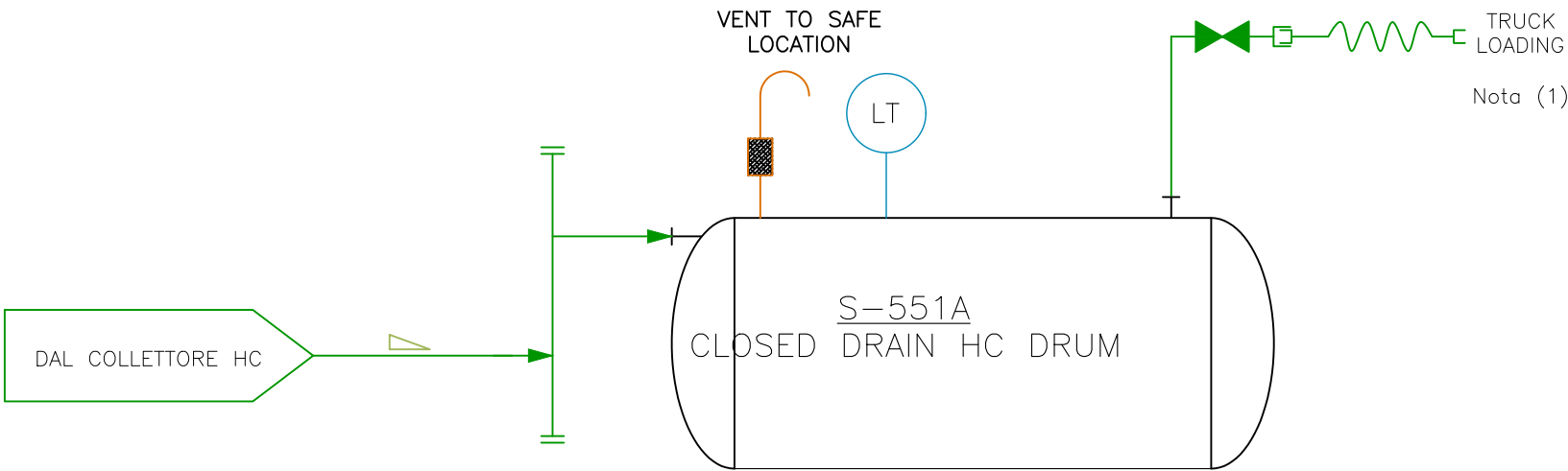
LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY LNEnergy			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO - ARIA STRUMENTI & SISTEMA AZOTO (Unità 500-650)		
SMALL SCALE LNG PLANT Collesanto gas field			PFD 15		
TIPO	SCALA	DENOMINAZIONE FILE:	FOGLIO/01		
A0	XX	—	1/1		

CONFIDENZIALE

UNITà 580



NOTE GENERALI:

- Funzionamento annuale previsto per 8000 ore

Note:

- (1) Il liquido di drenaggio viene inviato a trattamento/smaltimento attraverso cisterne di carico.

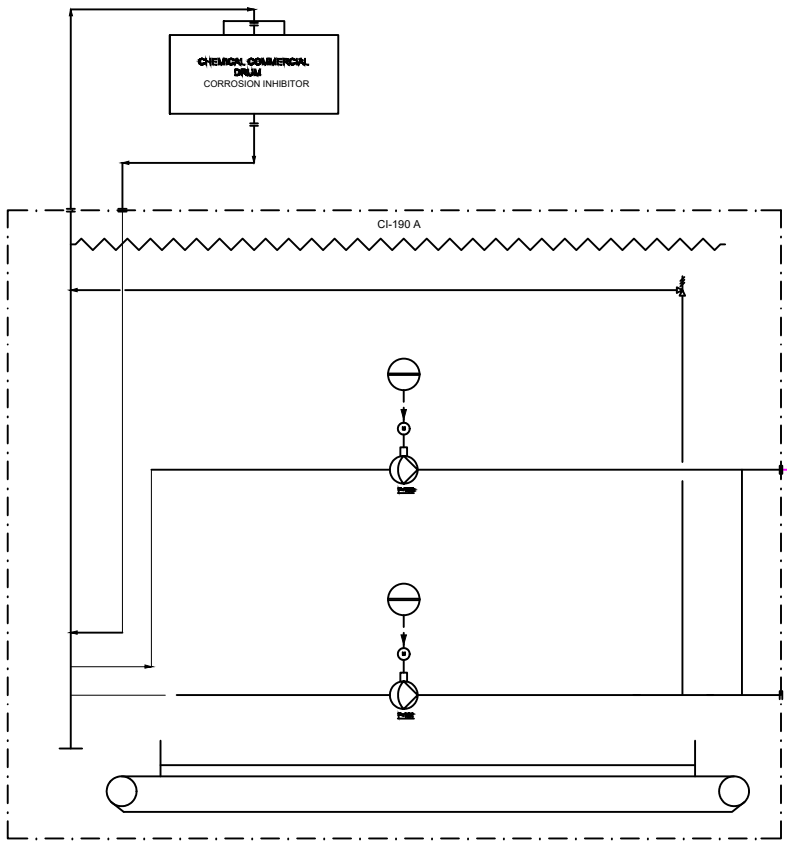
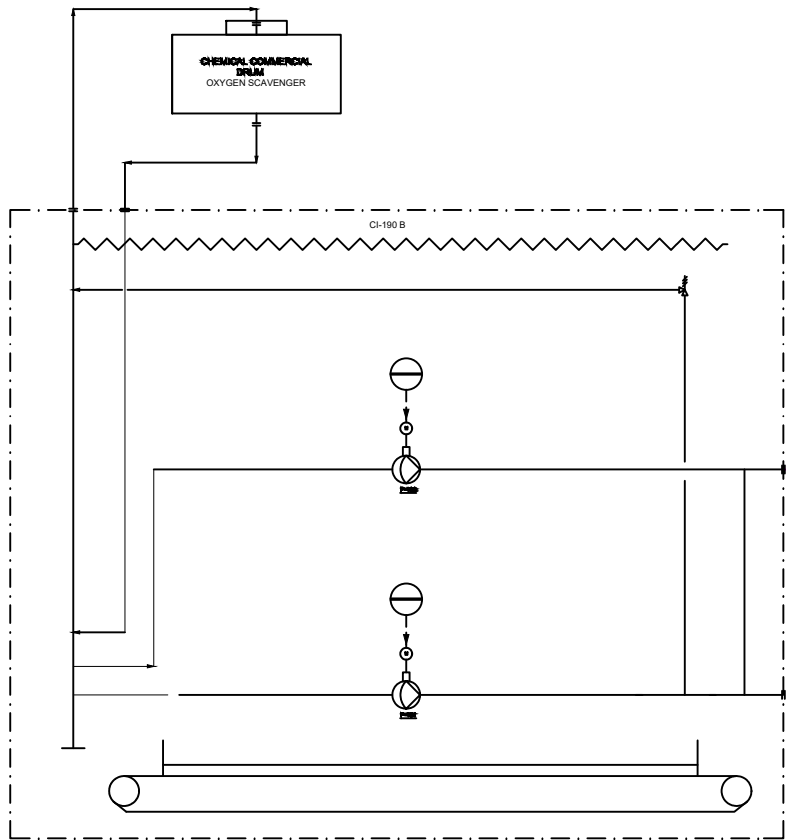
LISTA FLUIDI

	CONDENSATI		PSV
	GAS		REFRIGERANTE (AMMONIACA)
	ACQUA DI PROCESSO		LINEA STRUMENTALE
	AMMONIACA		DIESEL
	HOT OIL		GAS INERTE
	LNG		MR REFRIGERANTE MULTICOMPONENTE

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente					
LN Energy			-		
Contrattore					
Engea Consulting			-		
DG Impianti			-		
ITALFLUID COSMEP			-		
TITOLO:			OGGETTO: SCHEMA DI PROCESSO -		
SMALL SCALE LNG PLANT			CLOSED SYSTEM (Unità 580)		
Collesanto gas field					
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:		FOLIO/OT
A0	XX	-	PFD 16		1/1

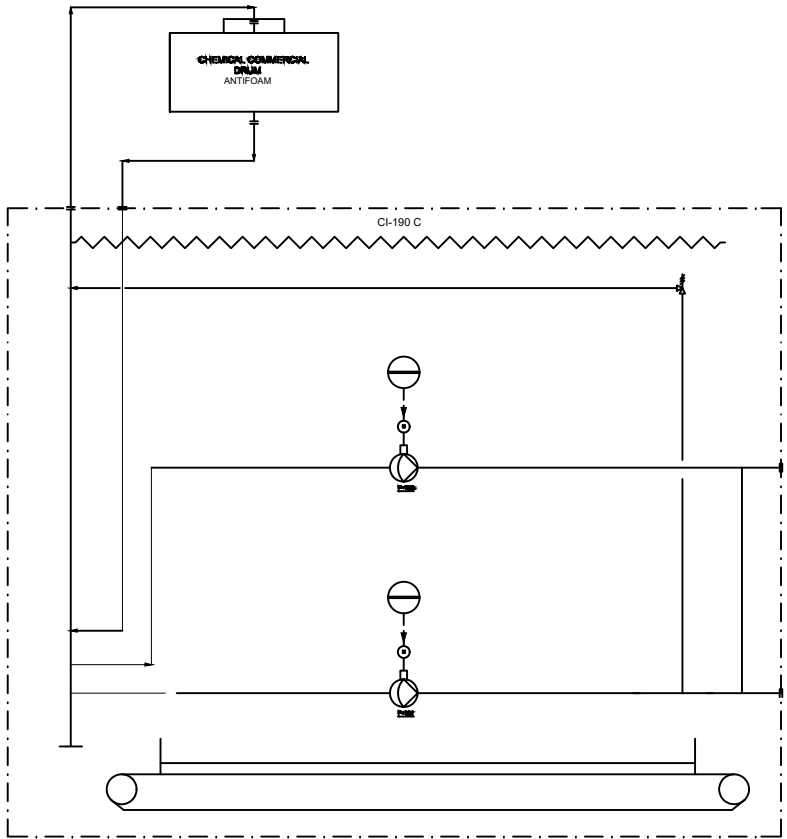
CONFIDENZIALE

INIEZIONE CHIMICI
UNITA' 190



OILY WATER TREATMENT

OILY WATER TREATMENT



LISTA FLUIDI

CONDENSATI	PSV
GAS	REFRIGERANTE (AMMONIACA)
ACQUA DI PROCESSO	LINEA STRUMENTALE
AMMONIACA	DIESEL
HOT OIL	GAS INERTE
LNG	MR REFRIGERANTE MULTICOMPONENTE
O ₂	

01	13-11-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
00	05-10-2023	EMISSIONE PER ENTI	DG Impianti	ITF Cosmep	ITF Cosmep
Rev.	Data	Descrizione	Elaborato	Verificato	Approvato
Cliente			—		
LNENERGY			—		
Contrattore			—		
ENGEA Engea Consulting			—		
DG Impianti			—		
ITALFLUID COSMEP			—		
TITOLO:			OGGETTO:		
SMALL SCALE LNG PLANT			SCHEMA DI PROCESSO —		
Collesanto gas field			INIEZIONI CHIMICI (Unità 190)		
TIPO	SCALA	DENOMINAZIONE FILE:	POSIZIONE DOCUMENTO:	FOGLIO/01	
A0	XX	—	PFD 17	1/1	