CP VR Exercise

Instructor Version

Canadian Pacific Railway

11207619 | Residential Yard - Small Release (1.1) | 03/26/21

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Please Fill This Page

- Participant Name: _____
- Organization: _____
- Title/Position: _____
- Exercise Role: **Facilitator ☐ Instructor ☐ Evaluator ☐ Sim Cell ☐ Other ☐**
- Date and Location: _____

CP

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #1 – Time : _____

CP Instructor Updates

- Canadian Pacific (CP) report of unplanned emergency stop at _____hrs. for a east bound CP freight train at Mile post _____
- Local Police contacted by CPPS
- CPPS is reporting Train Crew starts walking back for assessment

Additional Info (if required)

- Train Crew looks for air leaks on braking system
- Train Crew performs basic inspection, if possible
- All communications by Train Crew are by radio

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INSTRUCTOR PROMPTS

Incident Update #1

- Was any action required by local police? **Yes** ☐ **No** ☐
  - If yes, what actions? _____
- Was any action required by local fire? **Yes** ☐ **No** ☐
  - If yes, what actions? _____
- Are any roads blocked? **Yes** ☐ **No** ☐
  - If yes, does it affect the response? _____
- Other Information?
  - _____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #2 – Time : _____

CP Instructor Updates

- CPPS confirms to Local Police that the train has derailed
- Local 911 receiving numerous calls from citizens with odour complaints
- Any additional questions that should be asked?

Additional Info (if requested)

- Odours are described as a unpleasant sweet chemical odour similar to glue
- Report by CPPS from Train Crew notes approximately 5 cars involved
- *CPPS only calls Local Police, Fire would be contacted by Local Police.*

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INSTRUCTOR PROMPTS

Incident Update #2

- Given the new information:
  - Was any new actions required by local police? **Yes** ☐ **No** ☐
    - If yes, what action? _____
  - Was any new actions required by local fire? **Yes** ☐ **No** ☐
    - If yes, what action? _____
- Have First Responders established communication with CP? **Yes** ☐ **No** ☐
- Has emergency services requested paperwork? **Yes** ☐ **No** ☐
- What primary and secondary resources are being activated? (If required)
  - Eg. Hydro, Public Works, EMS, etc.
  - _____

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INSTRUCTOR PROMPTS

Incident Update #2

Other Information not covered

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #3 – Time : _____

CP Instructor Updates

- Fire department arriving on Site
  - Approximate response time

  _____
- CP Train Crew meets with First Responders*
- **Initiate virtual reality scene assessment**

Additional Background Info

- CP mobilizing assets
- CP Notifications
- *Distribute **Inject 1 – Example CP Notification***
- *Walk closer than personnel normally would to investigate the placards*

* No VR Train Crew available at present

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INSTRUCTOR PROMPTS

Incident Update #3

- Did fire department ask train crew to see train consist information? **Yes** ☐ **No** ☐
  - Once requested, distribute ***Inject #2 – Train Consist***
- Would first responders enter zone to identify potential leaks or assess from distance? _____
- Did first responders identify car marking numbers? **Yes** ☐ **No** ☐
  - If yes, what are they? _____ _____ _____ _____ _____ _____
  - Was AskRail used to identify commodities? (Optional) **Yes** ☐ **No** ☐
- Would you contact CANUTEC and/or CHEMTREC? **Yes** ☐ **No** ☐

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INSTRUCTOR PROMPTS

Incident Update #3 Cont.

- Did first responders identify car damage? **Yes** ☐ **No** ☐
  - If yes, where is the damage? _____
- Did first responders identify active leaks? **Yes** ☐ **No** ☐
  - If yes, what cars? _____ _____
- Did first responders identify placards on cars? **Yes** ☐ **No** ☐
  - If yes, what are they? _____ _____ _____
- What are the air readings in the initial assessment area?
  - LEL _____ O2_____ H2S_____ CO_____ VOC_____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #4 – Time : _____

CP Instructor Updates	Additional Info (if required)
• **Initial VR Assessment completed** • Car marking numbers identified by first responders • What are the DGs on Site? _____ _____ _____	• Shipper was notified by CP ▪ Product Waybills emailed to First Responders / IC ▪ Distribute ***Inject 3 – Product Waybills*** • CP Activates product ERAP (if asked) • Dangerous Goods on Site ▪ 1 Methyl Ethyl Ketone (MEK) (loaded) ▪ 1 Alcohols N.O.S (loaded) ▪ 1 Styrene Monomer (loaded)

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INSTRUCTOR PROMPTS

Incident Update #4

- Has FD evaluated Incident Command structure and setup? **Yes** ☐ **No** ☐
  - Eg. IC or Unified Command
  - If yes, what type? _____ If no, why? _____
- Has a provincial/state team been notified? **Yes** ☐ **No** ☐
- Has mutual aid been activated? **Yes** ☐ **No** ☐
  - If no, why/when would you? _____
- Did an evacuation occur? **Yes** ☐ **No** ☐
  - Who would handle this task? _____
- Did shelter in place occur? **Yes** ☐ **No** ☐
  - If yes, how is this information distributed? _____

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INSTRUCTOR PROMPTS

Incident Update #4

Fire Department - Other Information not covered

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INSTRUCTOR PROMPTS

Incident Update #4

Police - Other Information not covered

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INSTRUCTOR PROMPTS

Incident Update #4

EMS - Other Information not covered

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #5 – Time : _____

CP Instructor Updates

- SDSs from shipper are received by CP/First Responders
- CP DGO or sentinel arrives on-Site
- Additional Scene assessment with First Responders
- ***Re-enter VR Scenario***
- Begin detailed damage assessment with First Responders

Additional Info (if required)

- Distribute ***Inject 4 – Product SDS***
- Distribute ***Inject 5 – Blank CP Damage Assessment Forms***
- *Cast to iPad*

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INSTRUCTOR PROMPTS

Incident Update #5

- Were product leaks identified and estimated? **Yes** ☐ **No** ☐
  - Where are any identified leaks located? _____
- Was significant damage identified? **Yes** ☐ **No** ☐
  - If yes, where? (Jacket or Car Damage) _____
- Exclusion zone for SCBAs established? **Yes** ☐ **No** ☐ **N/A** ☐
  - 200 m / 650'? 800 m / 2,600'? Based on ERG? _____

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INSTRUCTOR PROMPTS

Incident Update #5

Any relevant receptors for air quality concerns? **Yes** ☐ **No** ☐

- Eg. hospitals, long-term care facilities, group homes, schools, prisons, public event areas, etc.
- If yes, which receptors? _____
- If yes, how do you approach these?_____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #6 – Time : _____

CP Instructor Updates

- CP and First Responders create initial Site map
- Complete damage assessment forms with First Responders
- Air monitoring plan initiated by CP
- Deployment of UAV assets, if not already deployed
- Determine active leaks and estimated volumes (if not completed)

Additional Info (if required)

- After hand map sketched distribute ***Inject 6 – UAV Arial Imagery***
- ~1,500 L (400 gal) leak from denatured ethanol SIOX 031002
- ~300 L (80 gal) leak from styrene PROX 023251

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INSTRUCTOR PROMPTS

Incident Update #6

- Is there a plan for stopping active leaks? **Yes** ☐ **No** ☐
  - With your current training could you stop a leak? **Yes** ☐ **No** ☐
- Is there a plan for product containment? **Yes** ☐ **No** ☐ **N/A** ☐
- Do you have any supplies to contain/control a large release? **Yes** ☐ **No** ☐ **N/A** ☐
- Is there a plan for protection of environmental receptors?
  - Waterways? **Yes** ☐ **No** ☐ **N/A** ☐ If yes, what? _____
  - Public? **Yes** ☐ **No** ☐ **N/A** ☐ If yes, what? _____
  - Storm drains? **Yes** ☐ **No** ☐ **N/A** ☐ If yes, what? _____
  - Infrastructure / properties? **Yes** ☐ **No** ☐ **N/A** ☐ If yes, what? _____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #7 – Time : _____

CP Instructor Updates

- Continued scene stabilization
- Public information officer coordinating with appropriate parties
- Air monitoring plan complete
- ***Share AR Scenario (IPAD / USDZ File)***

Additional Info (if required)

- Distribute ***Inject 7 – Air Monitoring Plan*** *if requested*

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INSTRUCTOR PROMPTS

Incident Update #7

- Has anyone asked CP to clear rail cars blocking roads? **Yes** ☐ **No** ☐ **N/A** ☐
- How would you communicate with CP? _____
- Has a communication plan for the public been established? **Yes** ☐ **No** ☐
  - If yes, was CP Media Relations consulted and what is the communication plan?
    _____
- Additional receptors to consider based on GIS Package? (If available) **Yes** ☐ **No** ☐
  - If yes, what are the receptors? _____
- What are the action levels for worker air monitoring? (if Hazmat team has capability)
  _____
- What are the action levels for the Site perimeter? (if Hazmat team has capability)
  _____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #8 – Time : _____

CP Instructor Updates

- Discretion of Instructor
- Any other relevant items to test or identify as part of Scenario

Additional Info (if required)

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INSTRUCTOR PROMPTS

Incident Update #8

- Discussion of any other response related items
  - Possible concerns are?

    _____

    _____

    _____

    _____
- If no additional concerns, move to next Incident Update

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #9 – Time : _____

CP Instructor Updates

- Imagery Shared from Site

Additional Info (if required)

- Distribute ***Inject 8 – Imagery from Site***

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INSTRUCTOR PROMPTS

Incident Update #9

- Does the imagery identify any additional concerns or Site controls needed that were not previously identified? **Yes** ☐ **No** ☐
  - Eg. blockades, fencing, decon, traffic control
- If yes, what are the additional concerns?

_____

_____

_____

_____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #10 – Time : _____

CP Instructor Updates

- Air monitoring consultant arrives conducting perimeter air monitoring
- CP provides initial air monitoring data from Site
- Perimeter air monitoring data shows that at a distance of 200 m (650') concentrations are below action levels

Additional Info (if required)

- Distribute ***Inject 9 – Air Monitoring Memo***

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INSTRUCTOR PROMPTS

Incident Update #10

- Can evacuations or shelter in place be scaled back? **Yes** ☐ **No** ☐
  - What distance should be maintained? _____
- What resources are required for Site hazmat work? Eg. Waste removal, Product storage, Vac Trucks
  - _____
- How long should air monitoring at perimeter stay in place?
  - _____
- Is data collected and distributed to the wider community? **Yes** ☐ **No** ☐

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Incident Update #11 – Time : _____

CP Instructor Updates

- CP assets, hazmat contractors, and heavy equipment arriving on Site
- CP is plugging, patching and capping cars as needed if not already complete

Additional Info (if required)

- Could involve more permanent solutions to initial controls

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INSTRUCTOR PROMPTS

Incident Update #11

- What is the effect on the area?
  - Transportation _____
  - Residential Access _____
  - Media _____
  - Public Concerns _____
  - Etc. _____

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INSTRUCTOR PROMPTS

Incident Update #11

- Is Incident Command organized for next OP? **Yes** ☐ **No** ☐
  - If yes, IC or Unified Command? _____
- What are some long term cleanup goals/activities?
  - _____
- Are there specific Site controls that need to be implemented?
  - _____

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TIMELINE OBJECTIVES - INSTRUCTOR GUIDE

Objectives for Next Operational Period

CP Objectives

- Site Safety
- Site Stabilization
- Product Transfers
- Continuity of Business
- Remediation
- Restoration
- Site Closure

First Responder Objectives

- Staffing requirements?
- Involvement during remaining phases?
- Restoring Local Institutions
  - Schools, Hospitals, etc.
- Local residents allowed to return
- Longer term road closures
- Any other disruptions to community?

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INSTRUCTOR PROMPTS

Next Operational Period

What are the Departments / Municipalities Objectives

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NEXT STEPS

What information, training and resources may help improve?

- Information – Eg. AskRail Applications, documents from CP (ICP & Forms)
- Training – Eg. RR101, FLBR, SERTC, HAZMAT: Awareness, HAZ TECH, 1081
- Resources – Eg. specialized equipment (midland kits)

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Inject 1
Example CP Notification

Scott Croome, CPR

Subject: FW: [2421 - NEW] CPPS Service Alert

From: CP Alerting Services <CP_Alert@cpr.ca<mailto:CP_Alert@cpr.ca>>
Time:
To: Scott Croome <Scott_Croome@cpr.ca<mailto:Scott_Croome@cpr.ca>>
Subject: [2421 - NEW] CPPS Service Alert

Subject: Collision Train Inv

Location -
Date of occurrence:
Time of occurrence:

Call source: RTC
Type of Incident: Collision Train Inv
Train #:

DGs involved, leak spills, waterways: Yes

Injuries: Unknown

Emergency Services Informed: Yes

Other CP Personnel Advised: ESR

Name: scott lavery

Adjacent To or On First Nations Land: No

Current situation/Incident description: Police communications have been notified train has derailed. PCPPS en rte.

Communications Officer: D502/H105

Inject 2
Train Consist

CANADIAN PACIFIC RAILWAY

```
#########################################################################
#                                                                       #
#   K   K  EEEEE   Y   Y       TTTTT   RRRR    AAAA   IIIII  N    N   #
#   K  K   E        Y Y          T     R   R  A    A    I     NN  N   #
#   KKK    EEE       Y           T     RRRR    AAAAA    I     N N N   #
#   K  K   E         Y           T     R  R    A    A    I     N  NN   #
#   K   K  EEEEE     Y           T     R   R  A    A  IIIII  N    N   #
#                                                                       #
#########################################################################
```

THIS TRAIN HANDLING SPECIAL DANGEROUS COMMODITIES
THIS TRAIN HANDLING LOADED HAZMAT DOT111 LEGACY TANK(S) SPECIAL HANDLING PROCEDURES MAY APPLY
THIS TRAIN CONTAINS THE FOLLOWING "KEY-TRAIN" HAZARDOUS MATERIALS LOADS:

		SET-OUT/PICK-UP			
CRUDE OIL Legacy DOT111 Tank Cars	0 (CRU)	_____	_____	_____	_____
CRUDE OIL CPC1232 Tank Cars or other	0 (CRU)	_____	_____	_____	_____
POISON INHALATION HAZARD Tank Cars	0 (PIH)	_____	_____	_____	_____
POISON INHALATION HAZARD NonTank Cars	0 (PIH)	_____	_____	_____	_____
CLASS 7 (SNF / HLRW)	0 (RAD)	_____	_____	_____	_____
HAZARDOUS MATERIALS (HAZ,FG,XA,ESC)	35	_____	_____	_____	_____
TOTAL:	35	_____	_____	_____	_____

POSITIVE CHAIN OF CUSTODY RULES APPLICABLE ONLY IN THE UNITED STATES
THIS SECTION MUST BE FILLED OUT AND FAXED TO CSF WITH CREW PAPERWORK
IF ANY ALERT LOADS HAVE BEEN DELIVERED /LIFTED/INTERCHANGED

EQUIPMENT ON BUILT TRAIN:

SEQ	INIT	NUMBER	CP EMPLOYEE NAME	CONTACT-EMPL NAME	DATE/TIME/TRACK
NIL					

EQUIPMENT ON WORK ORDER TO LIFT/PULL:

TRK	INIT	NUMBER	CP EMPLOYEE NAME	CONTACT-EMPL NAME	DATE/TIME/TRACK
NIL					

UNPLANNED WORK:

INIT	NUMBER	CP EMPLOYEE NAME	CONTACT-EMPL NAME	DATE/TIME/TRACK

CMRM MESSAGE KEY

PIH = POISON/ TOXIC INHALATION
RAD = CLASS 7 SNF / HLRW
ESC = ENVIRONMENTAL SENSITIVE CHEMICALS
CRU = CRUDE OIL
XA = CLASS 1.1 OR 1.2 EXPLOSIVES
FG = CLASS 2. FLAMMABLE GAS
HAZ = OTHER HAZARDOUS MATERIALS

CARS IN THIS CONSIST COUNT FROM HEAD TO REAR

OUTBOUND WHEEL REPORT FOR TRAIN 234WE27

```
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
 $  YOU ARE IN CHARGE OF HANDLING TRAIN  499WE27    FOR OUR VALUED CUSTOMERS  $
 $                                                                            $
 $ TO MAINTAIN OUR ON TIME  PERFORMANCE THIS TRAIN IS SCHEDULED TO DEPART:    $
 $                                                                            $
 $                                                                            $
 $                                                                            $
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
********************************************************************************
```

CLASS CODES IN THIS TRAIN

CLASS CODE	HEAD CAR	REAR CAR	LOADS	EMPTIES	TONS	LENGTH
7325MA1	CRYX 005181	CRGX 016033	1	14	782	1089
D08	SHPX 432397	FLOX 983262	0	3	84	126
M13	SOO 118993	SOO 118993	1	0	63	56
7700MA1	AOKX 078163	PROX 071607	27	7	3828	2046
8200M11	TR 805450	SOO 063529	2	21	971	1345
8200MA1	PROX 047211	PROX 044447	2	0	260	119
8200M11	CP 334160	PROX 041252	30	11	4130	2411
8200MA1	CP 600955	GATX 219409	1	7	404	450
8200M11	GNTX 295670	PROX 637183	1	1	168	139
8200MA1	CP 337266	TCMX 034354	6	9	1063	927
8526MA1	TTZX 086342	TTZX 086342	0	1	34	81
8200MA1	WCHX 030128	CP 220107	4	9	840	876

```
********************************************************************************

                AAR  L
SEQ INIT NUMBER TYPE E CMDTY TON CLASSCD CONSIGNE LTH FDOL     TIME/TRACK

000 CP   E008106 D127 E E                         74          NO WAYBILL
                ENGINE ASSIGNED BY LOCOMOTIVE MANAGEMENT SYSTEM
                  PLTF
000 CP   E008501 D127 E E                         74          NO WAYBILL
                ENGINE ASSIGNED BY LOCOMOTIVE MANAGEMENT SYSTEM

                  PLTF

001  CRYX 005181 R660 E POTAT  52 7325MA1 AMLOG CA  83 7762     ________________
                  PLTF
                  Cushioned Draw Bars

                  Car LENGTH exceeds 80 feet

002  CRYX 005282 R660 E POTAT  52 7325MA1 AMLOG CA  83 7762     ________________
                  PLTF
                  Cushioned Draw Bars

                  Car LENGTH exceeds 80 feet

003  CRYX 005141 R660 E POTAT  52 7325MA1 AMLOG CA  83 7762     ________________
                  PLTF
                  Cushioned Draw Bars

                  Car LENGTH exceeds 80 feet

004  CRYX 005169 R660 E POTAT  52 7325MA1 AMLOG CA  83 7762     ________________
                  PLTF
                  Cushioned Draw Bars
                  Car LENGTH exceeds 80 feet
```

005 CRYX 007065 R660 E POTAT 52 7325MA1 AMLOG CA 83 7762 _____
PLTF
Cushioned Draw Bars
Car LENGTH exceeds 80 feet

006 CRYX 005260 R660 E POTAT 52 7325MA1 AMLOG CA 83 7762 _____
PLTF
Cushioned Draw Bars
Car LENGTH exceeds 80 feet

007 CRYX 005301 R660 E POTAT 52 7325MA1 AMLOG CA 83 7762 _____
PLTF
Cushioned Draw Bars
Car LENGTH exceeds 80 feet

008 CRYX 005197 R660 E POTAT 52 7325MA1 AMLOG CA 83 7762 _____
PLTF
Cushioned Draw Bars
Car LENGTH exceeds 80 feet

009 CRYX 007055 R660 E POTAT 52 7325MA1 AMLOG CA 83 7762 _____
PLTF
Cushioned Draw Bars
Car LENGTH exceeds 80 feet

010 SDPX 096252 C114 L SOYBN 138 7325MA1 BALLCO F 60 7854 _____
In Bond

011 RBOX 033144 B314 E CARS, 31 7325MA1 LANTIC I 56 7765 _____

012 QC 077276 A406 E CARS, 35 7325MA1 TECK MET 59 9264 _____
Cushioned Draw Bars

013 QC 077189 A406 E CARS, 35 7325MA1 TECK MET 59 9264 _____
Cushioned Draw Bars

014 CRGX 029869 T108 E ANIMA 40 7325MA1 CARGILL 59 7880 _____

015 CRGX 016033 T107 E ANIMA 37 7325MA1 CARGILL 58 7880 _____

000 NS X073592 M970 E E NO WAYBILL

016 SHPX 432397 C112 E SODIU 27 D08 SASKATCH 43 6312 _____
Car Length Less Than 45 Feet

017 NAHX 330067 C112 E CRS,R 28 D08 SASKATCH 42 6312 _____
Car Length Less Than 45 Feet

018 FLOX 983262 C312 E CRS,R 28 D08 SASKATCH 42 6312 _____
Car Length Less Than 45 Feet

019 SOO 118993 C114 L CANOL 63 M13 VITERRA 56 6301 _____

020 AOKX 078163 C114 L DIST 134 7700MA1 THE SCOU 69 9088UP _____

021 AOKX 078166 C114 L DIST 134 7700MA1 THE SCOU 69 9088UP _____

022 AOKX 078176 C114 L DIST 134 7700MA1 THE SCOU 69 9088UP _____

```
023 AOKX  078181 C114 L DIST   134 7700MA1 THE SCOU   69 9088UP  _____________
024 AOKX  078180 C114 L DIST   134 7700MA1 THE SCOU   69 9088UP  _____________
025 MP    723258 C113 E CARS,   30 7700MA1 GRAYMONT   60 9089UP  _____________
026 UP    079640 C113 E CARS,   31 7700MA1 GRAYMONT   60 9089UP  _____________
027 UP    076189 C113 E CARS,   32 7700MA1 GRAYMONT   60 9089UP  _____________
028 OFOX  011580 C113 E CRS,R   30 7700MA1 GRAYMONT   60 9089UP  _____________
                 2000 FEET FROM THE LEAD LOCOMOTIVE
029 UP    075346 C113 E CARS,   31 7700MA1 GRAYMONT   60 9089UP  _____________
030 UP    074823 C113 E CARS,   30 7700MA1 GRAYMONT   60 9089UP  _____________
031 UP    079822 C113 E CARS,   32 7700MA1 GRAYMONT   60 9089UP  _____________
032 FURX  854260 C114 L CANOL 142  7700MA1 CENTRAL    62 9088UP  _____________
033 BNGX  032003 C114 L CANOL 142  7700MA1 CENTRAL    62 9088UP  _____________
034 FURX  854249 C114 L CANOL 142  7700MA1 CENTRAL    62 9088UP  _____________
035 AEX   015817 C114 L CANOL 142  7700MA1 CENTRAL    67 9088UP  _____________
036 NDYX  863382 C114 L CANOL 142  7700MA1 CENTRAL    70 9088UP  _____________
037 DME   051884 C114 L CANOL 142  7700MA1 CENTRAL    61 9088UP  _____________
038 DME   051670 C114 L CANOL 142  7700MA1 CENTRAL    60 9088UP  _____________
039 SOO   119774 C114 L CANOL 142  7700MA1 CENTRAL    56 9088UP  _____________
040 SOO   116829 C113 L CANOL 137  7700MA1 CENTRAL    56 9088UP  _____________
041 SOO   116094 C113 L CANOL 140  7700MA1 CENTRAL    56 9088UP  _____________
042 SOO   122646 C114 L CANOL 142  7700MA1 CENTRAL    56 9088UP  _____________
043 SOO   115138 C113 L CANOL 137  7700MA1 CENTRAL    56 9088UP  _____________
044 BNGX  030284 C114 L CANOL 142  7700MA1 CENTRAL    62 9088UP  _____________
045 CP    418518 M190 L RWY C    97 7700MA1 MANAGER    58 7700    _____________
                 Do not Hump or cut off in motion
                 Car Restricted in I/C by AAR Reason: Age
046 UTLX  672906 T106 L ASPH   125 7700MA1 OWENS CO   56 7705BNSF _____________
                 **** UN3257 ****
HAZ              Dangerous
HAZ              Key Train Load
047 PROX  075570 T106 L ASPH   126 7700MA1 OWENS CO   56 7705BNSF _____________
                 **** UN3257 ****
HAZ              Dangerous
```

```
HAZ              Key Train Load

048 PROX 074622 T106 L ASPH   126 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

049 PROX 071523 T106 L ASPH   127 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

050 PROX 072845 T106 L ASPH   125 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

051 PROX 071604 T106 L ASPH   127 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

052 PROX 071395 T106 L ASPH   127 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

053 PROX  071607 T106 L ASPH   127 7700MA1 OWENS CO  56 7705BNSF _________________
                 **** UN3257 ****
HAZ              Dangerous

HAZ              Key Train Load

054 TR    805450 G519 E CARS,   33 8200M11 EVRAZ DI  57 8205     _________________
                 Speed restricted to 50 MPH

055 TR    527193 E534 E CARS,   32 8200M11 EVRAZ DI  58 8205     _________________
                 Speed restricted to 50 MPH

056 TR    805402 G519 E CARS,   33 8200M11 EVRAZ DI  57 8205     _________________
                 Speed restricted to 50 MPH

057 TR    805382 E534 E CARS,   33 8200M11 CANADIAN  57 8480     _________________
                 Speed restricted to 50 MPH

058 TR    527272 G519 E CARS,   32 8200M11 EVRAZ DI  58 8205     _________________
                 Speed restricted to 50 MPH

059 SOO   063969 E534 E CARS,   31 8200M11 EVRAZ DI  58 8205     _________________
                 Speed restricted to 50 MPH

060 TR    527101 E534 E CARS,   32 8200M11 EVRAZ DI  58 8205     _________________
                 Speed restricted to 50 MPH

061 CP    429042 J303 E CARS,   29 8200M11 TERVITA   59 8285     _________________

062 TR    527517 E534 E CARS,   33 8200M11 EVRAZ DI  58 8205     _________________
                 Speed restricted to 50 MPH
```

063 SOO 063372 E534 E CARS, 31 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

064 TR 585622 E534 E CARS, 33 8200M11 EVRAZ DI 58 8205 _____

065 DME 080153 E534 E CARS, 33 8200M11 EVRAZ DI 57 8205 _____
Speed restricted to 50 MPH

066 TR 527887 E534 E CARS, 33 8200M11 EVRAZ DI 55 8205 _____

067 SOO 063983 E534 E CARS, 31 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

068 PROX 045197 T208 L FUEL 141 8200M11 ASHCROFT 60 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

069 PROX 045168 T208 L FUEL 141 8200M11 ASHCROFT 60 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

070 NKCR 003677 G719 E CARS, 38 8200M11 CANADIAN 72 8480 _____

071 CP 355085 G719 E CARS, 39 8200M11 CANADIAN 71 8480 _____

072 TR 527615 G519 E CARS, 33 8200M11 MOLY-COP 58 9598 _____
Speed restricted to 50 MPH

073 TR 805415 E534 E CARS, 33 8200M11 EVRAZ DI 57 8205 _____
Speed restricted to 50 MPH

074 TR 805445 E534 E CARS, 33 8200M11 EVRAZ DI 57 8205 _____
Speed restricted to 50 MPH

075 SOO 063287 E534 E CARS, 30 8200M11 EVRAZ DI 57 8205 _____
Speed restricted to 50 MPH

076 SOO 063529 E534 E CARS, 31 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

077 PROX 047211 T208 L FUEL 130 8200MA1 GIBSON E 60 8589 _____

078 PROX 044447 T108 L FUEL 130 8200MA1 GIBSON E 60 8589 _____

079 CP 334160 E232 L IRON/ 88 8200M11 EVRAZ IN 49 8556 _____
Cushioned Draw Bars

080 CP 334088 E232 L IRON/ 118 8200M11 EVRAZ IN 49 8556 _____
Cushioned Draw Bars

081 CP 334081 E232 L IRON/ 99 8200M11 EVRAZ IN 49 8556 _____
Cushioned Draw Bars

082 CP 334005 E232 L IRON/ 99 8200M11 EVRAZ IN 49 8205 _____
GROSS TONS MID-POINT INDICATOR TOTAL 12625 MID-POINT 6313
Cushioned Draw Bars

083 CP 334130 E232 L IRON/ 125 8200M11 EVRAZ IN 49 8205 _____
Cushioned Draw Bars

084 GATX 286255 T109 L FUEL 141 8200M11 ASHCROFT 60 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

085 PROX 041306 T108 L FUEL 130 8200M11 ASHCROFT 61 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

086 PROX 045303 T208 L FUEL 141 8200M11 ASHCROFT 60 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

087 PROX 043239 T108 L FUEL 130 8200M11 ASHCROFT 61 9636 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

088 PROX 045153 T208 L FUEL 141 8200M11 FEDERATE 60 7446 _____
**** UN1202 ****
HAZ Dangerous
HAZ Key Train Load

089 PROX 039974 T389 E TANK 50 8200M11 HARMATTA 68 8268 _____

090 BNSF 518626 G719 E CARS, 39 8200M11 STEEL ET 72 7704BNSF _____

091 GNTX 295445 G719 E CARS, 37 8200M11 GENERAL 71 8528 _____

092 TR 527316 G519 E CARS, 33 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

093 DME 080088 E534 E CARS, 34 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

094 GONX 320272 G516 E CARS, 35 8200M11 MOLY-COP 58 9598 _____

095 GNTX 295620 G719 E CARS, 38 8200M11 EVRAZ DI 71 8205 _____

096 GNTX 295525 G719 E CARS, 38 8200M11 EVRAZ DI 71 8205 _____

097 CP 355513 G719 E CARS, 38 8200M11 CAR MANA 72 9600 _____

098 SOO 063916 E534 E CARS, 30 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

099 TR 527099 E534 E CARS, 32 8200M11 EVRAZ DI 58 8205 _____
Speed restricted to 50 MPH

100 CP 334077 E232 L IRON/ 130 8200M11 EVRAZ IN 49 8556 _____
Cushioned Draw Bars

101 CP 334141 E232 L IRON/ 119 8200M11 EVRAZ IN 49 8556 _____

Cushioned Draw Bars

102 CP 334169 E232 L IRON/ 104 8200M11 EVRAZ IN 49 8556 _____

Cushioned Draw Bars

103 CP 334125 E232 L IRON/ 119 8200M11 EVRAZ IN 49 8556 _____

Cushioned Draw Bars

104 CP 334028 E232 L IRON/ 114 8200M11 EVRAZ IN 49 8556 _____

Cushioned Draw Bars

105 SRIX 023568 T106 L ASPH 123 8200M11 JEBRO IN 60 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

106 TEIX 025172 T107 L ASPH 130 8200M11 JEBRO IN 64 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

107 TEIX 025175 T107 L ASPH 130 8200M11 JEBRO IN 64 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

108 BRSX 001024 T107 L ASPH 131 8200M11 JEBRO IN 64 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

109 DBUX 250437 T107 L ASPH 130 8200M11 JEBRO IN 60 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

110 DBUX 250471 T107 L ASPH 130 8200M11 JEBRO IN 60 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

111 DBUX 250824 T107 L ASPH 130 8200M11 JEBRO IN 60 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

112 BRSX 001008 T107 L ASPH 131 8200M11 JEBRO IN 54 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

113 GATX 089539 T106 L ASPH 124 8200M11 JEBRO IN 56 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

HAZ Key Train Load

114 SRIX 023599 T106 L ASPH 123 8200M11 JEBRO IN 60 7705BNSF _____

**** UN3257 ****

HAZ Dangerous

```
 HAZ              Key Train  Load

115 TILX 309577 T389 L BUTAN 124 8200M11 PLAINS L  69 7705BNSF _________________
                 **** UN1075 ****
 FG              Dangerous
 FG              Key Train Load
 FG              US HAZMAT Special Hump
 FG              Canadian Special Dangerous Commodity

116 TILX 309649 T389 L BUTAN 123 8200M11 PLAINS L  69 7705BNSF _________________
                 **** UN1075 ****
 FG              Dangerous
 FG              Key Train Load
 FG              US HAZMAT Special Hump
 FG              Canadian Special Dangerous Commodity

117 TILX 190885 T108 L FUEL   130 8200M11 SHELL CA  60 8205     _________________
                 **** UN1202 ****
 HAZ             Dangerous
 HAZ             Key Train Load

118 TILX 360445 T108 L FUEL   141 8200M11 SHELL CA  60 8205     _________________
                 **** UN1202 ****
 HAZ             Dangerous
 HAZ             Key Train Load

119 PROX 041252 T108 L FUEL   130 8200M11 SHELL CA  66 8205     _________________
                 **** UN1202 ****
 HAZ             Dangerous
 HAZ             Key Train Load

120 CP   600955 C113 L CORN, 129 8200MA1 CARGILL   59 8481     _________________
                 In Bond

121 TILX 309520 T389 E GAS P   50 8200MA1 PLAINS M  69 8518CN   _________________
                 **** UN1075 ****
                 Dangerous

122 GATX 210320 T389 E GAS P   49 8200MA1 PLAINS M  69 8518CN   _________________
                 **** UN1075 ****
                 Dangerous

123 GATX 051565 T106 E TANK    36 8200MA1 IMPERIAL  56 8528     _________________

124 GATX 050097 T104 E TANK    30 8200MA1 SHELL CA  43 8518     _________________
                 Car Length Less Than 45 Feet

125 GATX 035786 T104 E TANK    30 8200MA1 SHELL CA  43 8518     _________________
                 Car Length Less Than 45 Feet

126 GATX 065637 T104 E TANK    30 8200MA1 SHELL CA  44 8518     _________________
                 Car Length Less Than 45 Feet
                 2000 FEET FROM TAIL END OF THE TRAIN

127 GATX 219409 T389 E TANK    50 8200MA1 KEYERA P  69 8594     _________________

128 GNTX 295670 G719 E CARS,   38 8200M11 EVRAZ DI  71 8205     _________________
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130 CP 337266 E735 E CARS, 38 8200MA1 EVRAZ DI 71 8205 _____

Speed restricted to 50 MPH

131 TQEX 58476 A606 E CARS, 38 8200MA1 TRENDWOO 67 8526 _____
PLTF

Cushioned Draw Bars

132 GATX 02809 T108 L METHY 128 3173MA1 BRENNTAG 60 3203 _____
**** UN1193 ****
HAZ Dangerous

HAZ Key Train Load

133 SIOX 031002 T208 L ETHYL 140 0508ET1 SHELL OI 60 4544NS _____
**** UN1987 ****
HAZ Dangerous

HAZ Key Train Load

134 PROX 023251 T107 L STYRE 129 4850MA1 DART CON 57 4544NS _____
**** UN2055 ****
HAZ Dangerous
HAZ In Bond

HAZ Key Train Load

135 SMW 737513 A302 E CARS, 33 8200MA1 STORAGE 56 9540 _____

136 CP 214741 A302 E CARS, 32 8200MA1 STORAGE 56 9540 _____

137 CP 216087 A402 E CARS, 34 8200MA1 STORAGE 58 9540 _____

Cushioned Draw Bars

138 FPAX 940102 C214 L POLYV 129 8200MA1 IPEX INC 65 9720SRY _____

In Bond

139 FPAX 930032 C214 L POLYV 131 8200MA1 IPEX INC 66 9720SRY _____

In Bond

140 FPAX 890068 C214 L POLYV 129 8200MA1 IPEX INC 69 9720SRY _____

In Bond

141 FPAX 890156 C214 L POLYV 130 8200MA1 IPEX INC 65 9720SRY _____

In Bond

142 UTLX 221523 T105 L CHEM, 126 8200MA1 LIQUIDS 54 8205 _____
**** UN3267 ****
HAZ Dangerous
HAZ In Bond

HAZ Key Train Load

143 SRY 009206 A405 E CARS, 34 8200MA1 DELIVERY 59 9720SRY _____
PLTF

Cushioned Draw Bars

144 SRY 009414 A405 E CARS, 36 8200MA1 DELIVERY 59 9720SRY _____
PLTF
Cushioned Draw Bars

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145 SRY  009209 A405 E CARS,  34 8200MA1 DELIVERY  59 9720SRY  _________________
                PLTF
                Cushioned Draw Bars
146 SRY  009408 A405 E CARS,  36 8200MA1 DELIVERY  59 9720SRY  _________________
                PLTF
                Cushioned Draw Bars
147 TCMX 034354 G719 L BEAMS 104 8200MA1 ARROW RE  71 8205     _________________
148 TTZX 086342 F383 E CARS,  34 8526MA1 ARROW RE  81 8526     _________________
                Cushioned Draw Bars
                Car LENGTH  exceeds 80 feet
149 WCHX 030128 T108 E TANK   33 8200MA1 ALBERTA   60 8205     _________________
150 ICE  067077 F423 L PLATE 129 8200MA1 RAPID SP  71 9600CN   _________________
                Cushioned Draw Bars
151 SOO  601065 F483 E CARS,  30 8200MA1 ARROW RE  81 9592     _________________
                Cushioned Draw Bars
                Car LENGTH  exceeds 80 feet
152 CP   214157 A302 E CARS,  33 8200MA1 STORAGE   56 9540     _________________
153 GNTX 297499 G719 L BEAMS 112 8200MA1 ARROW RE  72 8198     _________________
                In Bond
154 UTLX 203970 T108 L PETRO 127 8200MA1 LIQUIDS   60 8197     _________________
                In Bond
155 PROX 039789 T389 E PETRO  50 8200MA1 HARMATTA  68 8268     _________________
                 **** UN1075 ****
                Dangerous
156 PROX 696083 T389 E GAS P  50 8200MA1 HARMATTA  66 8268     _________________
                 **** UN1075 ****
                Dangerous
157 NS   120064 F483 L SECTS 126 8518MA1 ARROW RE  80 8526     _________________
                Cushioned Draw Bars
158 NS   120266 F483 L SECTS 126 8518MA1 ARROW RE  80 8526     _________________
                Cushioned Draw Bars
                In Bond
                Car LENGTH  exceeds 80 feet

              LOADS   EMPTIES   CONTENTS    TARE      E.G.T.     LENGTH
TRAIN TOTALS:   75       83        7029     5596       12625      10056

               TONNAGE TOTALS DO  N O T   INCLUDE OPERATIVE LOCOMOTIVES

TRAIN LENGTH EXCLUDING LEAD AND REMOTE LOCOMOTIVES   9659 FEET
TRAIN LENGTH INCLUDING LOCOMOTIVES                   9806 FEET

AVERAGE WEIGHT PER CAR                                 82 TONS
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#
COMPRESSED WAYBILLS  023427    3375-3250  4435
-------------------------------------------------------------------------------

*******************************************************************************
************* TRAIN IS CARRYING SPECIAL DANGEROUS COMMODITIES      *************
*******************************************************************************


**************************** DANGEROUS COMMODITIES *****************************


|                                                 PAGE    1 OF  1             |
|                                                                              |
|UTLX672906                 WB 469820 05/27/18  NET MASS   80379 KG 046 FM ENG.|
|PROX075570                 WB 469822 05/27/18  NET MASS   81095 KG 047 FM ENG.|
|PROX074622                 WB 469651 05/27/18  NET MASS   81061 KG 048 FM ENG.|
|PROX071523                 WB 469818 05/27/18  NET MASS   80442 KG 049 FM ENG.|
|PROX072845                 WB 469709 05/27/18  NET MASS   80579 KG 050 FM ENG.|
|PROX071604                 WB 469824 05/27/18  NET MASS   80545 KG 051 FM ENG.|
|PROX071395                 WB 469710 05/27/18  NET MASS   80407 KG 052 FM ENG.|
|PROX071607                 WB 469650 05/27/18  NET MASS   80717 KG 053 FM ENG.|
|                                                                              |
|CANADIAN PACIFIC                                                              |
|7550 OGDEN DALE ROAD SE                                                       |
|CALGARY        AB                                                             |
|T2C4X9         CA                                                             |
|                                                                              |
|SHIPMENT DESTINATION :                         SHIPMENT ORIGIN :              |
|                                                                              |
|                                                                              |
|TO:                                            FROM:                          |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|                                                                              |
|8 TANK CARS                             STCC 4961619                          |
|UN 3257                                 EMERGENCY 24-HOUR NUMBER 800-555-9999 |
|ELEVATED TEMPERATURE                    CONTRACT HOLDER: CONTRACT 2-M-0136    |
|LIQUID, N.O.S.                                                                |
|(ASPHALT)                                                                     |
|CLASS 9                                                                       |
|PG  III                                                                       |
|BROKER: AN DERINGER INC                                                       |
|                                                                              |
|I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND          |
|ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED,    |
|PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER    |
|CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE  INTERNATIONAL AND NATIONAL  |
|GOVERNMENT REGULATIONS.                                                       |
|(DAVE MAY)                                                                    |
|                                                                              |
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********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

PROX045197 WB 461886 05/26/18 NET MASS 94569 KG 068 FM ENG.
PROX045168 WB 461885 05/26/18 NET MASS 94914 KG 069 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

2 TANK CARS
UN 1202
DIESEL FUEL
CLASS 3
PG III

STCC 4912210
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER:
CONSUMERS COOP REFINERY
ERP NO 2-1933-008
ERP PHONE 1-800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(WHITNEY TREFIAK)

********** DANGEROUS COMMODITIES **********

| PAGE 1 OF 1 |

GATX286255	WB 454970 05/25/18	NET MASS	94581 KG 084 FM ENG.
PROX041306	WB 454959 05/25/18	NET MASS	88058 KG 085 FM ENG.
PROX045303	WB 454927 05/25/18	NET MASS	94560 KG 086 FM ENG.
PROX043239	WB 454923 05/25/18	NET MASS	88329 KG 087 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:

SHIPMENT ORIGIN :

FROM:

4 TANK CARS
UN 1202
DIESEL FUEL
CLASS 3
PG III

STCC 4912210
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER:
CONSUMERS COOP REFINERY
ERP NO 2-1933-008
ERP PHONE 1-800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(WHITNEY TREFIAK)

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

PROX045153 WB 454916 05/25/18 NET MASS 94708 KG 088 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

1 TANK CAR
UN 1202
DIESEL FUEL
CLASS 3
PG III

STCC 4912210
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER:
CONSUMERS COOP REFINERY
ERP NO 2-1933-008
ERP PHONE 1-800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(WHITNEY TREFIAK)

********** DANGEROUS COMMODITIES **********

| PAGE 1 OF 1 |

SRIX023568	WB	441071	05/24/18	NET MASS	78841	KG	105 FM ENG.
TEIX025172	WB	441165	05/24/18	NET MASS	84983	KG	106 FM ENG.
TEIX025175	WB	441215	05/24/18	NET MASS	85331	KG	107 FM ENG.
BRSX001024	WB	441081	05/24/18	NET MASS	85158	KG	108 FM ENG.
DBUX250437	WB	441155	05/24/18	NET MASS	84033	KG	109 FM ENG.
DBUX250471	WB	441067	05/24/18	NET MASS	83527	KG	110 FM ENG.
DBUX250824	WB	441068	05/24/18	NET MASS	84269	KG	111 FM ENG.
BRSX001008	WB	441157	05/24/18	NET MASS	84830	KG	112 FM ENG.
GATX089539	WB	441069	05/24/18	NET MASS	79476	KG	113 FM ENG.
SRIX023599	WB	441162	05/24/18	NET MASS	78754	KG	114 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:

SHIPMENT ORIGIN :

FROM:

10 TANK CARS
UN 3257
ELEVATED TEMPERATURE
LIQUID, N.O.S.
(ASPHALT)
CLASS 9
PG III

STCC 4961619
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER: COOP REFINERY

BROKER: CN CUSTOMS BROKERAGE SERVICES

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(NICOLE SHEWCHUK)

********** SPECIAL DANGEROUS COMMODITIES **********

PAGE 1 OF 1

TILX309577 WB 441791 05/24/18 NET MASS 66490 KG 115 FM ENG.
TILX309649 WB 441381 05/24/18 NET MASS 66364 KG 116 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

****
* SPECIAL COMMODITY *
****

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

2 TANK CARS
UN 1075
LIQUEFIED PETROLEUM GAS
(BUTANE)
CLASS 2.1
BROKER: AN DERINGER INC

STCC 4905424
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER: CO OP REFINERY
ERP NO 2-1933-008
ERP PHONE 800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(KAHLA GORRILL)

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

TILX190885	WB 441407 05/24/18	NET MASS	87755 KG	117 FM ENG.
TILX360445	WB 441412 05/24/18	NET MASS	86755 KG	118 FM ENG.
PROX041252	WB 441415 05/24/18	NET MASS	85329 KG	119 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

3 TANK CARS
UN 1202
DIESEL FUEL
CLASS 3
PG III

STCC 4912210
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER:
CONSUMERS COOP REFINERY
ERP NO 2-1933-008
ERP PHONE 1-800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(WHITNEY TREFIAK)

********** RESIDUE CARS **********

PAGE 1 OF 1

TILX309520	WB 444459 05/24/18 NET MASS	0 LB 121 FM ENG.
GATX210320	WB 444458 05/24/18 NET MASS	0 LB 122 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

2 TANK CARS
RESIDUE LAST CONTAINED
UN 1075
LIQUEFIED PETROLEUM GAS
(PROPANE)
CLASS 2.1

STCC 4905419
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER: CHEMTREC CCN23163
ERP NO 2-0010-059
ERP PHONE 800-555-9999

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

PROX637183 WB 385584 05/18/18 NET MASS 86889 KG 129 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:

SHIPMENT ORIGIN :

FROM:

1 TANK CAR
UN 1202
DIESEL FUEL
CLASS 3
PG III

STCC 4912210
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER:
CONSUMERS COOP REFINERY
ERP NO 2-1933-008
ERP PHONE 1-800-555-9999

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(WHITNEY TREFIAK)

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

UTLX221523 WB 164000 05/16/18 NET MASS 180507 LB 139 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

1 TANK CAR
UN 3267
CORROSIVE LIQUID, BASIC,
ORGANIC, N.O.S.
(ACQ-C2)
CLASS 8
PG III
BROKER: JB ELLIS & COMPANY LTD

STCC 4935263
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER: CHEMTREC/4541

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********************************* RESIDUE CARS *********************************
|                                                    PAGE   1 OF   1             |
|                                                                                |
|PROX039789                 WB 925761 05/15/18  NET MASS       0 LB 152 FM ENG.|
|                                                                                |
|CANADIAN PACIFIC                                                                |
|7550 OGDEN DALE ROAD SE                                                         |
|CALGARY        AB                                                               |
|T2C4X9         CA                                                               |
|                                                                                |
|SHIPMENT DESTINATION :                          SHIPMENT ORIGIN :               |
|                                                                                |
|                                                                                |
|TO:                                             FROM:                           |
|                                                                                |
|                                                                                |
|                                                                                |
|                                                                                |
|                                                                                |
|1 TANK CAR                                 STCC 4905752                         |
|RESIDUE LAST CONTAINED                     EMERGENCY 24-HOUR NUMBER 800-555-9999|
|UN 1075                                    CONTRACT HOLDER: CNN624201           |
|LIQUEFIED PETROLEUM GAS                    ERP NO 2-0010-134                    |
|CLASS 2.1                                  ERP PHONE 800-555-9999               |
|(NON-ODORIZED, NON- CORROSIVE)                                                  |
|TN: (PROPANE, NON-ODORIZE                                                       |
|--------------------------------------------------------------------------      |
```

```
******************************** RESIDUE CARS ********************************
|                                                 PAGE   1 OF   1              |
|-----------------------------------------------------------------------------|
|PROX696083                WB 930400 05/06/18  NET MASS       0 KG 153 FM ENG.|
|                                                                             |
|CANADIAN PACIFIC                                                             |
|7550 OGDEN DALE ROAD SE                                                      |
|CALGARY        AB                                                            |
|T2C4X9         CA                                                            |
|                                                                             |
|SHIPMENT DESTINATION :                         SHIPMENT ORIGIN :             |
|                                                                             |
|                                                                             |
|TO:                                            FROM:                         |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|                                                                             |
|1 TANK CAR                            STCC 4905419                           |
|RESIDUE LAST CONTAINED                EMERGENCY 24-HOUR NUMBER 1-800-555-9999|
|UN 1075                               CONTRACT HOLDER:                       |
|LIQUEFIED PETROLEUM GAS               CONSIGNOR: HARMATTAN GAS PROCESSING    |
|(PROPANE)                             EMERGENCY 24-HOUR NUMBER 1-800-555-9999|
|CLASS 2.1                             CONTRACT HOLDER:                       |
|                                      CHEMTREC CONTRACT NO. CCN 223612       |
|                                      ERP NO 2-0010-134                      |
|                                      ERP PHONE 800-555-9999                 |
|-----------------------------------------------------------------------------|
```

********** DANGEROUS COMMODITIES **********

| PAGE 1 OF 1 |

GATX029809 WB 352327 12/15/17 NET MASS 180000 LB 156 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION : SHIPMENT ORIGIN :

TO: FROM:

1 TANK CAR STCC 4909243
UN 1193 EMERGENCY 24-HOUR NUMBER 800-555-9999
ETHYL METHYL KETONE CONTRACT HOLDER: SHELL CHEMICAL CO.
CLASS 3
PG II
RQ (METHYL ETHYL KETONE)
SWITCH SERVICE
BROKER: LIVINGSTON INTERNATIONAL INC

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

SIOX031002 WB 786245 01/11/18 NET MASS 190368 LB 154 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:

SHIPMENT ORIGIN :

FROM:

1 TANK CAR
UN 1987
ALCOHOLS, N.O.S.
CLASS 3
PG II
(ALCOHOLS, N.O.S.)

STCC 4909152
EMERGENCY 24-HOUR NUMBER 800-555-9999
CONTRACT HOLDER: RPMG INC
ERP NO 2-1933-054
ERP PHONE 800-555-9999

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

PROX023251 WB 791135 01/11/18 NET MASS 84445 KG 155 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

SHIPMENT ORIGIN :

TO:

FROM:

1 TANK CAR
UN 2055
STYRENE MONOMER,
STABILIZED
CLASS 3
PG III

STCC 4907265
EMERGENCY 24-HOUR NUMBER 1 800-555-9999
CONTRACT HOLDER: SHELL CHEMICALS CANADA

EXPECTED DELIVERY (0125 0000)

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(FREDERIC MCQUISTON)

Inject 3
Product Waybills

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

GATX029809 WB 352327 12/15/17 NET MASS 180000 LB 156 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:
BRENNTAG CANADA INC
60 TITAN RD
ETOBICOKE ON
M8Z2J8 CA

SHIPMENT ORIGIN :

FROM:
SHELL CHEMICAL CO
5900 HWY 225
DEER PARK TX
77536 US

1 TANK CAR
UN 1193
ETHYL METHYL KETONE
CLASS 3
PG II
RQ (METHYL ETHYL KETONE)
SWITCH SERVICE
BROKER: LIVINGSTON INTERNATIONAL INC

STCC 4909243
EMERGENCY 24-HOUR NUMBER 8005559999
CONTRACT HOLDER: SHELL CHEMICAL CO.

If interested in a full scale exercise, contact your local DGO/HMO

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

SIOX031002 WB 786245 01/11/18 NET MASS 190368 LB 154 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:
GLOBAL COMPANIES LLC
800 SOUTH ST
WALTHAM MA
02454 US

SHIPMENT ORIGIN :

FROM:
RENEWABLE PRODUCTS MARKETING G
1157 VALLEY PARK DR STE 100
SHAKOPEE MN
553791900 US

1 TANK CAR
UN 1987
ALCOHOLS, N.O.S.
CLASS 3
PG II
(ALCOHOLS, N.O.S.)

STCC 4909152
EMERGENCY 24-HOUR NUMBER 8005559999
CONTRACT HOLDER: RPMG INC
ERP NO 2-1933-054
ERP PHONE 8005559999

If interested in a full scale exercise, contact your local DGO/HMO

********** DANGEROUS COMMODITIES **********

PAGE 1 OF 1

PROX023251 WB 791135 01/11/18 NET MASS 84445 KG 155 FM ENG.

CANADIAN PACIFIC
7550 OGDEN DALE ROAD SE
CALGARY AB
T2C4X9 CA

SHIPMENT DESTINATION :

TO:
STYROCHEM CANADA LTEE
19250 CLARK GRAHAM AVE
BAIE-D'URFE PQ
H9X3R8 CA

SHIPMENT ORIGIN :

FROM:
SHELL CHEMICALS CANADA
55520 RG RD 214
FORT SASKATCHEWAN AB
T8L4A4 CA

1 TANK CAR
UN 2055
STYRENE MONOMER,
STABILIZED
CLASS 3
PG III
EXPECTED DELIVERY (0125 0000)

STCC 4907265
EMERGENCY 24-HOUR NUMBER 1 8005559999
CONTRACT HOLDER: SHELL CHEMICALS CANADA

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY THE PROPER SHIPPING NAME,AND ARE CLASSIFIED, PACKAGED, MARKED AND LABELLED/PLACARDED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT ACCORIDING TO APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.
(FREDERIC MCQUISTON)

If interested in a full scale exercise, contact your local DGO/HMO

Inject 4
Safety Data Sheets (SDS)

Inject 4.1
Methyl Ethyl Ketone

Version	Revision Date:	SDS Number:	Print Date: 2017-09-07
5.0	2016-09-13	800001033918	Date of last issue: 21.10.2011
			Date of first issue: 16.10.2003

SECTION 1. IDENTIFICATION

Product name : Methyl Ethyl Ketone

Product code : S2113

Manufacturer or supplier's details

Manufacturer/Supplier : **Shell Chemicals Canada**
PO Box 4280 STN C
CALGARY AB T2T 5Z5
Canada

Telephone : 1-855-697-4355

Telefax : 1-866-213-7508

Emergency telephone number

CHEMTREC (24 hr) : 1-800-424-9300
Canutec (24 hr) : 1-613-996-6666; Toll Free: 1-888-CAN-UTEC (226-8832)

Recommended use of the chemical and restrictions on use

Recommended use : Use only in industrial processes.

Restrictions on use : This product must not be used in applications other than the above without first seeking the advice of the supplier.

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids : Category 2

Eye irritation : Category 2A

Specific target organ toxicity - single exposure : Category 3 (Central nervous system, Narcotic effects)

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : PHYSICAL HAZARDS:
H225 Highly flammable liquid and vapour.
HEALTH HAZARDS:

H319 Causes serious eye irritation.
H336 May cause drowsiness or dizziness.
ENVIRONMENTAL HAZARDS:
Not classified as an environmental hazard under GHS criteria.

Precautionary statements : **Prevention:**
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P240 Ground and bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use non-sparking tools.
P243 Take action to prevent static discharges.
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash hands thoroughly after handling.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
Response:
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower.
P370 + P378 In case of fire: Use appropriate media to extinguish.
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/ attention.
P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTER/doctor if you feel unwell.
Storage:
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P235 Keep cool.
P405 Store locked up.
Disposal:
P501 Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other hazards which do not result in classification
Vapours are heavier than air. Vapours may travel across the ground and reach remote ignition sources causing a flashback fire danger.
Even with proper grounding and bonding, this material can still accumulate an electrostatic charge.
If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.
Exposure may enhance the toxicity of other materials.
See Chapter 11 for details.
Repeated exposure may cause skin dryness or cracking.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Substance

Substance name : Methyl Ethyl Ketone 78-93-3

Synonyms : butan-2-one, Ethyl methyl ketone, MEK

Hazardous components

Chemical name	CAS-No.	Concentration (% w/w)
Methyl ethyl ketone	78-93-3	<= 100

SECTION 4. FIRST-AID MEASURES

General advice : DO NOT DELAY.
Keep victim calm. Obtain medical treatment immediately.

If inhaled : Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.

In case of skin contact : Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available.
If persistent irritation occurs, obtain medical attention.

In case of eye contact : Immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. Transport to the nearest medical facility for additional treatment.

If swallowed : If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.
If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.

Most important symptoms and effects, both acute and delayed : If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever.
Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance.
Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision.
Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, lightheadedness, headache, nausea and loss of coordination.
Continued inhalation may result in unconsciousness and death.

Protection of first-aiders : When administering first aid, ensure that you are wearing the appropriate personal protective equipment according to the

incident, injury and surroundings.

Notes to physician : Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Call a doctor or poison control center for guidance.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Alcohol-resistant foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.

Unsuitable extinguishing media : None

Specific hazards during fire-fighting : The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Carbon monoxide may be evolved if incomplete combustion occurs.

Specific extinguishing methods : Standard procedure for chemical fires.

Further information : Clear fire area of all non-emergency personnel.
Keep adjacent containers cool by spraying with water.

Special protective equipment for firefighters : Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Observe the relevant local and international regulations
Notify authorities if any exposure to the general public or the environment occurs or is likely to occur.
Local authorities should be advised if significant spillages cannot be contained.
The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Vapour may form an explosive mixture with air.
Avoid contact with skin, eyes and clothing.
Isolate hazard area and deny entry to unnecessary or unprotected personnel.
Stay upwind and keep out of low areas.

Environmental precautions : Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment to avoid environmental contamination.

Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Ventilate contaminated area thoroughly.
Monitor area with combustible gas indicator.

Methods and materials for containment and cleaning up : For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely
For small liquid spills (< 1 drum), transfer by mechanical means to a labeled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely Remove contaminated soil and dispose of safely.

Additional advice : For guidance on selection of personal protective equipment see Chapter 8 of this Safety Data Sheet.
For guidance on disposal of spilled material see Chapter 13 of this Safety Data Sheet.

SECTION 7. HANDLING AND STORAGE

General Precautions : Avoid breathing of or direct contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Safety Data Sheet.
Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Ensure that all local regulations regarding handling and storage facilities are followed.

Advice on protection against fire and explosion : Bulk storage tanks should be diked (bunded). Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Do NOT use compressed air for filling, discharging, or handling operations.

Advice on safe handling : Avoid contact with skin, eyes and clothing.

Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols.

Avoidance of contact : Strong oxidising agents.

Advice on protection against fire and explosion : Bulk storage tanks should be diked (bunded). Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Do NOT use compressed air for filling, discharging, or handling operations.

Product Transfer : Refer to guidance under Handling section.

Storage

Conditions for safe storage : The vapour is heavier than air. Beware of accumulation in pits and confined spaces.
Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.

Packaging material : Suitable material: For containers, or container linings use mild steel, stainless steel.
Unsuitable material: Natural, butyl, neoprene or nitrile rubbers.

Container Advice : Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.

Specific use(s) : Not applicable

Ensure that all local regulations regarding handling and storage facilities are followed.
See additional references that provide safe handling practices: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity).
IEC/TS 60079-32-1: Electrostatic hazards, guidance

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis

Methyl ethyl ketone	78-93-3	TWA	200 ppm	ACGIH
		STEL	300 ppm	ACGIH
		TWA	200 ppm 590 mg/m3	OSHA Z-1

Biological occupational exposure limits

Components	CAS-No.	Control parameters	Biological specimen	Sampling time	Permissible concentration	Basis
Methyl ethyl ketone	78-93-3	methyl ethyl ketone	Urine	End of shift (As soon as possible after exposure ceases)	2 mg/l	ACGIH BEI

Monitoring Methods

Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory.
Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available.
National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/
Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous Substances http://www.hse.gov.uk/
Institut für Arbeitsschutz Deutschen Gesetzlichen Unfallversicherung (IFA) , Germany http://www.dguv.de/inhalt/index.jsp
L'Institut National de Recherche et de Securité, (INRS), France http://www.inrs.fr/accueil

Engineering measures : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include:
Use sealed systems as far as possible.
Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.
Local exhaust ventilation is recommended.
Firewater monitors and deluge systems are recommended.
Eye washes and showers for emergency use.
Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.

General Information:
Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and

protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned.
Practice good housekeeping.
Define procedures for safe handling and maintenance of controls.
Educate and train workers in the hazards and control measures relevant to normal activities associated with this product.
Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation.
Drain down system prior to equipment break-in or maintenance.
Retain drain downs in sealed storage pending disposal or subsequent recycle.

Personal protective equipment

Respiratory protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation.
Check with respiratory protective equipment suppliers.
Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.
Where air-filtering respirators are suitable, select an appropriate combination of mask and filter.
If air-filtering respirators are suitable for conditions of use:
Select a filter suitable for organic gases and vapours [Type A boiling point >65°C (149°F)].

Hand protection
Remarks : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection. Longer term protection: Butyl rubber. Nitrile rubber. Incidental contact/Splash protection: PVC or neoprene rubber gloves. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Glove thickness should be typically greater than 0.35 mm depending on the glove make and model. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical

resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

Eye protection : Wear goggles for use against liquids and gas.
Wear full face shield if splashes are likely to occur.

Skin and body protection : Wear antistatic and flame retardant clothing if a local risk assessment deems it so.
Skin protection is not required under normal conditions of use.
For prolonged or repeated exposures use impervious clothing over parts of the body subject to exposure.
If repeated and/or prolonged skin exposure to the substance is likely, then wear suitable gloves tested to relevant Standard, and provide employee skin care programmes.

Thermal hazards : Not applicable

Protective measures : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
The following information, while appropriate for the product is general in nature. The selection of Personal Protective Equipment will vary depending on the conditions of use.

Hygiene measures : Wash hands before eating, drinking, smoking and using the toilet.
Launder contaminated clothing before re-use.

Environmental exposure controls

General advice : Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.
Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.
Information on accidental release measures are to be found in section 6.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquid.

Colour : clear

Odour : characteristic

Odour Threshold	:	Data not available
pH	:	Not applicable
Melting point/freezing point	:	-86 °C / -123 °F
Boiling point/boiling range	:	79.5 °C / 175.1 °F
Flash point	:	-9 °C / 16 °F
Evaporation rate	:	3.3 Method: DIN 53170, di-ethyl ether=1
Flammability (solid, gas)	:	Not applicable
Upper explosion limit	:	upper flammability limit 11.5 %(V)
Lower explosion limit	:	lower flammability limit 1.8 %(V)
Vapour pressure	:	12.600 Pa (20 °C / 68 °F)
Relative vapour density	:	2.4 (20 °C / 68 °F)
Relative density	:	804 - 806 (20 °C / 68 °F) Method: ASTM D4052
Density	:	804 - 806 kg/m3 (20 °C / 68 °F)Method: ASTM D4052
Solubility(ies)		
Water solubility	:	250 g/l Miscible. (20 °C / 68 °F)
Partition coefficient: n-octanol/water	:	log Pow: 0.3
Auto-ignition temperature	:	515 °C / 959 °F
Decomposition temperature	:	Data not available
Viscosity		
Viscosity, dynamic	:	0.42 mPa.s (20 °C / 68 °F)
Viscosity, kinematic	:	Data not available
Explosive properties	:	Not applicable
Oxidizing properties	:	Data not available

Surface tension	:	24.8 mN/m, 20 °C / 68 °F
Conductivity	:	Electrical conductivity: > 10 000 pS/m, A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid, This material is not expected to be a static accumulator.
Molecular weight	:	72.11 g/mol

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	The product does not pose any further reactivity hazards in addition to those listed in the following sub-paragraph.
Chemical stability	:	No hazardous reaction is expected when handled and stored according to provisions
Possibility of hazardous reactions	:	Reacts with strong oxidising agents.
Conditions to avoid	:	Avoid heat, sparks, open flames and other ignition sources. Prevent vapour accumulation. In certain circumstances product can ignite due to static electricity.
Incompatible materials	:	Strong oxidising agents.
Hazardous decomposition products	:	Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases including carbon monoxide, carbon dioxide, sulphur oxides and unidentified organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

SECTION 11. TOXICOLOGICAL INFORMATION

Basis for assessment : Information given is based on product testing.

Information on likely routes of exposure
Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.

Acute toxicity

Product:

Acute oral toxicity	:	LD50 (Rat): >2000 - <= 5000 mg/kg Remarks: May be harmful if swallowed.
Acute inhalation toxicity	:	LC50: 5000 ppm Remarks: Low toxicity:

Acute dermal toxicity : LD50 (Rabbit): > 5,000 mg/kg
Remarks: Low toxicity:

Skin corrosion/irritation

Product:
Remarks: Not irritating to skin.

Serious eye damage/eye irritation

Product:
Remarks: Causes serious eye irritation.

Respiratory or skin sensitisation

Product:
Remarks: Not expected to be a sensitiser.

Germ cell mutagenicity

Product:
Genotoxicity in vivo : Remarks: Not mutagenic.

Carcinogenicity

Product:
Remarks: Not expected to be carcinogenic.

IARC	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.
OSHA	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.
NTP	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.

Reproductive toxicity

Product:
Effects on fertility :
Remarks: Not expected to impair fertility.
Not a developmental toxicant.

STOT - single exposure

Product:

Remarks: May cause drowsiness and dizziness.

STOT - repeated exposure

Product:

Remarks: Low systemic toxicity on repeated exposure.
Repeated exposure may cause skin dryness or cracking.

Aspiration toxicity

Product:

Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.

Further information

Product:

Remarks: Classifications by other authorities under varying regulatory frameworks may exist.

SECTION 12. ECOLOGICAL INFORMATION

Basis for assessment : Information given is based on product testing.

Ecotoxicity

Product:

Toxicity to fish (Acute toxicity)	:	Remarks: Practically non toxic: LL/EL/IL50 > 100 mg/l
Toxicity to crustacean (Acute toxicity)	:	Remarks: Practically non toxic: LL/EL/IL50 > 100 mg/l
Toxicity to algae/aquatic plants (Acute toxicity)	:	Remarks: Practically non toxic: LL/EL/IL50 > 100 mg/l
Toxicity to fish (Chronic toxicity)	:	Remarks: Data not available
Toxicity to crustacean (Chronic toxicity)	:	Remarks: Data not available
Toxicity to microorganisms (Acute toxicity)	:	Remarks: Practically non toxic: LL/EL/IL50 > 100 mg/l

Persistence and degradability

Product:

Biodegradability : Remarks: Readily biodegradable.
Oxidises rapidly by photo-chemical reactions in air.

Bioaccumulative potential

Product:

Bioaccumulation : Remarks: Not expected to bioaccumulate significantly.

Partition coefficient: n-octanol/water : log Pow: 0.3

Mobility in soil

Product:

Mobility : Remarks: Dissolves in water.

Other adverse effects

Product:

Additional ecological information : Not expected to have ozone depletion potential.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues : Recover or recycle if possible.
It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Do not dispose into the environment, in drains or in water courses
Waste product should not be allowed to contaminate soil or water.

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 and must be complied with.

Contaminated packaging : Drain container thoroughly.
After draining, vent in a safe place away from sparks and fire.
Residues may cause an explosion hazard.
Do not, puncture, cut, or weld uncleaned drums.
Send to drum recoverer or metal reclaimer.

SECTION 14. TRANSPORT INFORMATION

TDG

UN number	:	1193
Proper shipping name	:	METHYL ETHYL KETONE
Class	:	3
Packing group	:	II
Labels	:	3
Marine pollutant	:	no

International Regulations

IATA-DGR

UN/ID No.	:	UN 1193
Proper shipping name	:	METHYL ETHYL KETONE
Class	:	3
Packing group	:	II
Labels	:	3

IMDG-Code

UN number	:	UN 1193
Proper shipping name	:	ETHYL METHYL KETONE
Class	:	3
Packing group	:	II
Labels	:	3
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution category	:	Z
Ship type	:	3
Product name	:	Methyl ethyl ketone
Special precautions	:	Refer to Chapter 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

Special precautions for user

Remarks	:	Special Precautions: Refer to Chapter 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

Additional Information **:** This product may be transported under nitrogen blanketing. Nitrogen is an odourless and invisible gas. Exposure to nitrogen may cause asphyxiation or death. Personnel must observe strict safety precautions when involved with a confined space entry.

SECTION 15. REGULATORY INFORMATION

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

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.
This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (HPR) and the SDS contains all the information required by the HPR.

The components of this product are reported in the following inventories:

AICS	:	Listed
DSL	:	Listed
IECSC	:	Listed
KECI	:	Listed
PICCS	:	Listed
EINECS	:	Listed
TSCA	:	Listed

SECTION 16. OTHER INFORMATION

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; CPR - Controlled Products Regulations; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); 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; ERG - Emergency Response Guide; 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; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; 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; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

A vertical bar (|) in the left margin indicates an amendment from the previous version.
Due to the conversion of this product to GHS classification and labelling, there has been a significant change to the nature of the information presented in chapter 2.

Sources of key data used to compile the Safety Data Sheet	:	The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).
Revision Date	:	2016-09-13

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

CA / EN

Inject 4.2
Ethanol

1. IDENTIFICATION

Product Identifier	Denatured Fuel Grade Ethanol
Synonyms:	Denatured alcohol, alcohol with gasoline
Intended use of the product:	Fuel Additive
Contact:	Global Companies LLC Water Mill Center 800 South St. Waltham, MA 02454-9161 www.globalp.com
Contact Information:	EMERGENCY TELEPHONE NUMBER (24 hrs): CHEMTREC (800) 424-9300 COMPANY CONTACT (business hours): 800-542-0778

2. HAZARD IDENTIFICATION

According to OSHA 29 CFR 1910.1200 HCS

Classification of the Substance or Mixture

Classification (GHS-US):

Flammable Liquid	Category 2	H225
Eye Irritation	Category 2	H319
Aspiration Hazard	Category 1	H304

Labeling Elements

Signal Word (GHS-US):	**Danger**
Hazard Statements (GHS-US):	H225 – Highly flammable liquid and vapor H319 – Causes serious eye irritation H304 – May be fatal if swallowed and enters airways.
Precautionary Statements (GHS-US):	P201 - Obtain special instructions before use. P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking. P233 - Keep container tightly closed. P280 - Wear protective gloves/protective clothing/eye protection/face protection. P303+361+353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse with water. P403 - Store in a well-ventilated place. Keep cool. P405 - Store locked up. P501 – Dispose of contents/container in accordance with local/regional/national/international regulation.

Other information:

NFPA 704
Health:1
Fire: 3
Reactivity: 0

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Composition Information

Name	Product Identifier (CAS#)	% (w/w)	Classification
Gasoline	8006-61-9	2	Carc 1B, H350; Irr. H319 Flam Liq 2 H225 Aspiration H304
Ethyl Alcohol (Ethanol)	64-17-5	98-100	Flam Liq 2 H225

Additional Formulation Information

Also see Section 15 for list of SARA Section 313 toxic chemicals.

4. FIRST AID MEASURES

Route	Measures
Inhalation	Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.
Ingestion	Aspiration Hazard. DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.
Eye Contact	If present, remove contact lenses. In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 minutes. Hold eyelids open to ensure adequate flushing. Seek medical attention.
Skin Contact	Remove contaminated clothing and shoes. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.
Absorption	As with skin contact, remove contaminated clothing and flush with copious amounts of water. Flush affected area for at least 15 minutes to minimize potential for further absorption. Seek medical attention if significant portions of skin have been exposed.

Most Important Symptoms

Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

Immediate Medical Attention and Special Treatment

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs).

Application of epinephrine may cause cardiac arrhythmia in persons exposed to large quantities of hydrocarbon vapor or due to skin absorption. Observe for development of symptoms leading to cardiac arrhythmia.

Contaminated clothing, including shoes may present a fire hazard and should be discarded

Medical Conditions Aggravated by Exposure
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

5. FIRE-FIGHTING MEASURES

Extinguishing Media
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, C02, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Specific Hazards / Products of Combustion
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard. Alcohol flames may not be visible.

Combustion may produce smoke, carbon monoxide and other products of incomplete combustion.

Special Precautions and Protective Equipment for Firefighters
Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other firefighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full face piece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 9 for fire properties of this chemical including flash point, autoignition temperature, and explosive limits

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

ACTIVATE FACILITY SPCC, SPILL CONTINGENCY or EMERGENCY PLAN.

Depending on the size of the spill, downwind receptors may need to be notified.

Evacuate nonessential personnel and remove or secure all ignition sources (flame, spark, hot work, hot metal, etc.). Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Do not touch or walk-through spilled material.

Highly flammable material, even small spills may pose a fire danger for emergency responders. Due to high vapor density, flammable / toxic vapors may be present in low lying areas, dikes, pits, drains, or trenches. Ventilate the area. Use of non-sparking tools and intrinsically safe equipment is recommended. Potential for flammable atmosphere should be monitored using a combustible gas indicator positioned down wind of the spill area. See Sections 2 and 7 for further hazard warnings and handling instructions.

Use appropriate personal protective equipment to prevent eye/skin contact and absorption. Use NIOSH approved respiratory protection, if warranted, to prevent exposures above permissible limits (see Section 8). Contaminated clothing should not be near sources of ignition.

Environmental Precautions
Stop the spill to prevent environmental release if it can be done safely. Product may be toxic to aquatic life. Take action to isolate environmental receptors including drains, storm sewers and natural water bodies. Keep on impervious surface if at all possible. Use water sparingly to prevent product from spreading. Foam and absorbents may be used to reduce / prevent

airborne release.

Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Follow federal, state or local requirements for reporting environmental release where necessary (see Section 15 for further information)

Containment and Clean-Up Methods
Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with dry earth, sand or other non-combustible, inert absorbing materials. Carefully shovel, scoop or sweep up into a waste container with clean, non-sparking tools for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING AND STORAGE

Handling Precautions
USE ONLY AS A MOTOR FUEL ADDITVE
DO NOT SIPHON BY MOUTH

Handle as a flammable liquid. Keep away from heat, sparks, and open flame. No smoking. Electrical equipment should be approved for classified area. Bond and ground containers during product transfer pursuant to NFPA 70 and API RP 2003 to reduce the possibility of static-initiated fire or explosion. Follow precautions to prevent static initiated fire.

Use good personal hygiene practices. Use only with protective equipment specified in Section 8. Avoid repeated and/or prolonged skin exposure. Use only outdoors or in well ventilated areas. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves. Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure.

Vapors are heavier than air and can accumulate in low lying areas (e.g., tanks, pits, vaults, dikes, drains, etc.) Follow specific procedures for confined space entry in areas where product may be present pursuant to OSHA requirements in 29 CFR 1910.146. Atmospheric testing using a combustible gas indicator may be necessary in confined areas where product may be present.

Storage
Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Label all secondary containers that this material is transferred into with the chemical name and associated hazard(s). Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition. Separate from incompatible materials (see Section 10) by distance or secondary containment.

Store in a well-ventilated area. Protect containers from damage and vehicular traffic. Post “No Smoking” signs in product storage areas. This storage area should comply with NFPA 30 “Flammable and Combustible Liquid Code”. Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 “Cleaning Mobile Tanks In Flammable and Combustible Liquid Service” and API RP 2015 “Cleaning Petroleum Storage Tanks”.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Limits

Component	CAS #	List	Value
Gasoline	8006-61-9	ACGIH TWA ACGIH STEL	300 ppm 500 ppm
Ethyl Alcohol (Ethanol)	64-17-5	ACGIH STEL OSHA PEL	1000 ppm 1000 ppm

*Skin designation indicates the chemical is skin absorbable

Engineering Controls

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces. Intrinsically safe equipment and non-sparking tools shall be used in circumstances where concentrations may exceed lower flammable limits. Grounding and bonding shall be used to prevent accumulation and discharge of static electricity.

Emergency shower and eyewash should be provided in proximity to handling areas in the event of exposure to decontaminate.

Personal Protective Equipment

Exposure	Equipment
Eye / Face	Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.
Skin	Gloves constructed of nitrile or neoprene are recommended when handling this material. If contact with the body is expected, chemical protective clothing such as of E.I. DuPont Tychem ®, Barricade®, or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.
Respiratory	A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations. Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection. Specific requirements under the OSHA occupational exposure to Benzene may apply if concentrations exceed the action level or permissible limits. Consult 29 CFR 1910.1028 for further information)
Thermal	Product is stored at ambient temperature. No thermal protection is required except for emergency operations involving actual or potential for fire.

9. PHYSICAL AND CHEMICAL PROPERTIES

Property	Value	Comments
Appearance	A clear, water-like liquid	
Odor	Alcohol or Gasoline-like	
Odor Threshold	See table below	

Parameter	Odor Detection	Odor Recognition
Non-oxygenated gasoline	0.5-0.6 ppm	0.8-1.1 ppm
Ethanol	0.2-0.3 ppm	0.4-0.7 ppm

Property	Value	Comments
pH	Not available	
Melting / Freeze Point	> -30 ˚F	
Boiling Point And Range	160-171 ^{0}F (71 to 77 ^{0}C) (based on Gasoline)	
Flash Point	44.5 ^{0}F (7 ^{0}C) (Based on Gasoline)	
Evaporation Rate	4-8	(n-butyl acetate = 1)
Flammability	Flammable liquid	
Flammability Limits	3-23%	(est)
Vapor Pressure	45 mm Hg @ 70 ºF (21 ºC)	
Vapor Density	1.6	
Specific Gravity	0.76-0.9	(water =1)
Solubility	Non-oxygenated gasoline-negligible (<0.1% @77 ^{0}F). Gasoline with 10% Ethanol has greater solubility than other oxygenates	
Partition Coefficient	<1	as Log P
Autoignition Temperature	highly variable; >530 ^{0}F (>280 C)	
Decomposition Temperature	Evaporation or ignition likely before decomposition will occur	
Viscosity	<1 cSt	
Percent Volatiles	100%	

10. STABILITY AND REACTIVITY

Reactivity
Material is not self reacting, flammable concentrations may be present in air.

Stability
Normally stable unless mixed with incompatibles or fire in presence of an ignition source. Material is flammable liquid.

Reactions / Polymerization
Stable. Hazardous polymerization will not occur.

Conditions to Avoid
Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

Incompatible Materials
Keep away from strong acids and oxidizers.

Hazardous Decomposition Products
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity:

Acute Toxicity (Inhalation LC50)
Gasoline (8006-61-9)
LC50 Inhalation Human 2000 ppm/1 hr

Ethanol (64-17-5)
LC50 Inhalation Rat >20,000 ppm/10 hr

Ethanol (64-17-5)
LD50 Oral Rat 7060 mg/kg

Acute Toxicity (Dermal LD50)
Gasoline (8006-61-9)
LD50 Dermal Rabbit >5 mL/kg

Skin Corrosion/Irritation: Causes skin irritation.

Serious Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: May cause genetic defects.

Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

The IARC has determined that there is sufficient evidence indicating that alcoholic beverages (ethanol) are carcinogenic in humans (Group 1). They have determined that there is inadequate evidence that gasoline is carcinogenic in humans and limited evidence that it is carcinogenic in animals. However, IARC has designated MATERIAL SAFETY DATA SHEET Denatured Fuel Grade Ethanol Page 5 of 6 Revision 04/03/2012 gasoline as possibly carcinogenic to humans (Group 2B) due to the fact that gasoline contains benzene.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. The NTP, ARC, OSHA and ACGIH list benzene as a human carcinogen.

Reproductive Toxicity: May damage/Suspected of damaging fertility or the unborn child.

Teratogenicity: Not available

Specific Target Organ Toxicity (Repeated Exposure): Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Specific Target Organ Toxicity (Single Exposure): Single over-exposure likely to cause central nervous system effects (dizziness and drowsiness), excessive exposure could cause paralysis or cardiac arrhythmia.

Aspiration Hazard: This chemical is considered to be an aspiration hazard. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Potential Health Effects: Vapor irritating to eyes, nose, and throat. Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur. Inhalation at high concentrations in confined spaces with less than 16% oxygen needed to sustain life, skin and /or eye contact (liquid).

Chronic effects: Human inhalation (chronic) >500 ppm (approx. 1.8 mg/L)/ day. Effects: May cause vomiting, diarrhea, insomnia, headache dizziness, anemia, muscle & neurological symptoms.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

12. ECOLOGICAL INFORMATION

Toxicity
Material is toxic to aquatic organisms on an acute basis (LC50/EC50 between 1 and 10 mg/L in the most sensitive species tested).

EC50 Daphnia	30 mmol/m3 (Exposure time: 48 h - Species: Daphnia magna)
LC 50 Fish	7.7 mg/l (Exposure time: 96 h - Species: Pimephales promelas)

Persistence and Degradation: Not expected to persist in the environment.

Bioaccumulative Potential: Not available

Mobility in Soil: Not available

Other Adverse Effects: None known

Other Information: Avoid release to the environment.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options. May be considered a hazardous waste if disposed. Direct solid waste (landfill) or incineration at a solid waste facility is not permissible. Do not discharge to sanitary or storm sewer. Personnel handling waste containers should follow precautions provided in this document.

Shipping containers must be DOT authorized packages. Follow licensure and regulations for transport of hazardous material and hazardous waste as applicable.

14. TRANSPORT INFORMATION

US DOT

UN Identification Number	NA 1987
Proper Shipping Name	Denatured alcohol
Hazard Class and Packing Group	3, PG II
Shipping Label	Flammable Liquid
Placard / Bulk Package	Flammable
Emergency Response Guidebook Guide Number	128

IATA Cargo

UN Identification Number	UN 1987
Shipping Name / Description	Alcohols, n.o.s.
Hazard Class and Packing Group	3, PG II
ICAO Label	Ethanol and Gasoline
Packing Instructions Cargo	364, Y341
Max Quantity Per Package Cargo	60 L

IATA Passenger

UN Identification Number	UN 1987
Shipping Name / Description	Alcohols, n.o.s.
Hazard Class and Packing Group	3, PG II
ICAO Label	3
Packing Instructions Passenger	353, Y341
Max Quantity Per Package	5 L

IMDG

UN Identification Number	UN 1987
Shipping Name / Description	Alcohols, n.o.s.
Hazard Class and Packing Group	3, PG II
IMDG Label	3
EmS Number	F-E S-E
Marine Pollutant	Yes

15. REGULATORY INFORMATION

U.S. Federal, State, and Local Regulatory Information
Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

OSHA Hazard Communication Standard
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

Superfund Amendments and Reauthorization Act of 1986 Title III (Emergency Planning and Community Right-to-Know Act of 1986) Sections 311 and 312

Immediate (Acute) Health Hazard	Yes
Delayed (Chronic) Health Hazard	Yes
Fire Hazard	Yes
Reactive Hazard	No
Sudden Release of Pressure Hazard	No

Clean Water Act (Oil Spills)
Any spill or release of this product to “navigable waters” (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA Section 103 and SARA Section 304 (Release to the Environment)
The CERCLA definition of hazardous substances contains a “petroleum exclusion” clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA Section 313- Supplier Notification
This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

- Benzene (71-43-2)
- Benzene (71-43-2) for reformulated gasoline
- Ethyl benzene (100-41-4)
- n-Hexane (110-54-3)
- Toluene (108-88-3)
- 1,2,4- Trimethylbenzene (95-63-6)
- Xylene, mixed isomers (1330-20-7)

Information on each ingredient’s concentration can be found in Section 3

Information on each ingredient’s exposure limits can be found in Section 8

EPA Notification (Oil Spills)
If the there is a discharge of more than 1,000-gallons of oil (2%) into or upon navigable waters of the United States, or if it is the second spill event of 42 gallons or more of oil into water within a twelve (12) month period, a written report must be submitted to the Regional Administrator of the EPA within sixty days of the event.

Pennsylvania Right to Know Hazardous Substance list:
The following product components are cited in the Pennsylvania Special Hazardous Substance List, and are present at levels which require reporting.

Component	CAS	Amount
Benzene	71-43-2	Trace
Xylene	1330-20-7	Trace
Toluene	108-88-3	Trace
1,2,4-Trimethylbenzene	95-63-6	Trace
Ethyl Benzene	100-41-4	Trace
Ethyl Alcohol	64-17-5	98%

New Jersey Right to Know Hazardous Substance list:
The following product components are cited in the New Jersey Right to Know Hazardous Substance List, and are present at levels which require reporting.

Component	CAS	Amount
Gasoline	8006-61-9	2%
Benzene	71-43-2	Trace
Xylene	1330-20-7	Trace
Toluene	108-88-3	Trace
1,2,4-Trimethylbenzene	95-63-6	Trace
Ethyl Benzene	100-41-4	Trace
Ethyl Alcohol	64-17-5	98%

California Prop. 65
WARNING: This product contains chemicals known to the State of California to cause Cancer or Reproductive Toxicity.

Component	CAS	Amount
Benzene	71-43-2	<0.1%
Toluene	108-88-3	<0.1%
Ethyl Benzene	100-41-4	<0.1%
Ethyl Alcohol	64-17-5	98%

U.S. Toxic Substances Control Act
All components of this product are on the TSCA Inventory or are exempt from TSCA Inventory requirements under 40 CFR 720.30.

CEPA - Domestic Substances List (DSL)
All substances contained in this product are listed on the Canadian Domestic Substances List (DSL) or are not required to be listed.

Canadian Regulatory Information (WHMIS)
Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION

Version	3.0
Issue Date	May 2015
Prior Issue Date	April 2012

Description of Revisions
Revised to meet Globally Harmonized System for chemical hazard communication requirements pursuant to OSHA regulatory revisions 77 FR 17884, March 26, 2012.

Abbreviations

˚F	Degrees fahrenheit (temperature)	>	Greater than
<	Less than	AP	Approximately
=	Equal to	C	Centigrade (temperature)

kg	Kilogram
L	Liter
mg	Milligrams
mL	Milliliter
mm^2	Square millimeters
mmHg	Millimeters of mercury (pressure)
ppm	Parts per million
sec	Second
ug	Micrograms

Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
AL	Action Level
ANSI	American National Standards Institute
API	American Petroleum Institute
CAS	Chemical Abstract Service
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation
EC50	Ecological concentration 50%
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
GHS	Global Harmonized System
HMIS	Hazardous Materials Information System
IARC	International Agency for Research On Cancer
IATA	International Air Transport Association
IMDG	International Maritime Dangerous Goods
Koc	Soil Organic Carbon
LC50	Lethal concentration 50%
LD50	Lethal dose 50%
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act Reauthorization Act of 1986 Title III
REL	Recommended Exposure Limit (NIOSH)
RVP	Reid Vapor Pressure
SARA	Superfund Amendments and
SCBA	Self Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
UN	United Nations
UNECE	United Nations Economic Commission for Europe
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

Disclaimer of Expressed and Implied Warranties

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

** End of Safety Data Sheet **

Inject 4.3
Styrene Monomer

Version	Revision Date:	SDS Number:	Print Date: 2017-09-07
2.6	2016-10-14	800001004869	Date of last issue: 15.04.2016
			Date of first issue: 20.10.2003

SECTION 1. IDENTIFICATION

Product name : Styrene Monomer

Product code : Q9211, Q9215, Q9257

Manufacturer or supplier's details

Manufacturer/Supplier : **Shell Chemicals Canada**
PO Box 4280 STN C
CALGARY AB T2T 5Z5
Canada

Telephone : 1-855-697-4355

Telefax : 1-866-213-7508

Emergency telephone number

CHEMTREC (24 hr) : 1-800-424-9300
Canutec (24 hr) : 1-613-996-6666; Toll Free: 1-888-CAN-UTEC (226-8832)

Recommended use of the chemical and restrictions on use

Recommended use : Base chemical for the production of polystyrene, rubbers and resins.

Restrictions on use : Restricted to professional users., This product must not be used in applications other than the above without first seeking the advice of the supplier.

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids : Category 3

Aspiration hazard : Category 1

Skin irritation : Category 2

Eye irritation : Category 2A

Acute Toxicity (Inhalation) : Category 4

Specific target organ toxicity - single exposure : Category 3 (Respiratory Tract)

Specific target organ toxicity - repeated exposure : Category 1 (Auditory system)

Chronic aquatic toxicity : Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : PHYSICAL HAZARDS:
H226 Flammable liquid and vapour.
HEALTH HAZARDS:
H304 May be fatal if swallowed and enters airways.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H332 Harmful if inhaled.
H335 May cause respiratory irritation.
H372 Causes damage to organs (Auditory system) through prolonged or repeated exposure if inhaled.
ENVIRONMENTAL HAZARDS:
H412 Harmful to aquatic life with long lasting effects.

Precautionary statements : **Prevention:**
P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P240 Ground and bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use non-sparking tools.
P243 Take action to prevent static discharges.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264 Wash hands thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
P273 Avoid release to the environment.
Response:
P370 + P378 In case of fire: Use appropriate media to extinguish.
P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P331 Do NOT induce vomiting.
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/ attention.

P304 + P340 IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P312 Call a POISON CENTER/doctor if you feel unwell.
Storage:
P403 + P233 Store in a well-ventilated place. Keep container tightly closed.
P235 Keep cool.
P405 Store locked up.
Disposal:
P501 Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other hazards which do not result in classification
Vapours are heavier than air. Vapours may travel across the ground and reach remote ignition sources causing a flashback fire danger.
Highly reactive.
Maintain dissolved oxygen and inhibitor at proper levels to prevent runaway polymerisation.
May form flammable/explosive vapour-air mixture.
This material is a static accumulator.
Even with proper grounding and bonding, this material can still accumulate an electrostatic charge.
If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Substance

Substance name : Styrene Monomer 100-42-5

Synonyms : Phenyl ethene, Phenyl ethylene, Vinyl benzene

Hazardous components

Chemical name	CAS-No.	Concentration (% w/w)
styrene	100-42-5	99 - 100

Stabilised with tertiary butyl catechol., 10-15 ppm.

SECTION 4. FIRST-AID MEASURES

General advice : Take appropriate steps to avoid fire, explosion and inhalation hazards.

If inhaled : Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.

In case of skin contact : Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available.

In case of eye contact : Flush eye with copious quantities of water.
If persistent irritation occurs, obtain medical attention.

If swallowed	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Most important symptoms and effects, both acute and delayed	:	If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. Defatting dermatitis signs and symptoms may include a burning sensation and/or a dried/cracked appearance. Skin irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blisters. Auditory system effects may include temporary hearing loss and/or ringing in the ears. Visual system disturbances may be evidenced by decreases in the ability to discriminate between colours.
Protection of first-aiders	:	When administering first aid, ensure that you are wearing the appropriate personal protective equipment according to the incident, injury and surroundings.
Notes to physician	:	Potential for chemical pneumonitis. Call a doctor or poison control center for guidance.

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media	:	Do not use water in a jet.
Specific hazards during fire-fighting	:	Flammable vapours may be present even at temperatures below the flash point. Sustained fire attack on vessels may result in a Boiling Liquid Expanding Vapor Explosion (BLEVE). The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water. Hazardous combustion products may include: Carbon monoxide. Formaldehyde
Specific extinguishing methods	:	Standard procedure for chemical fires.
Further information	:	Clear fire area of all non-emergency personnel. All storage areas should be provided with adequate fire

fighting facilities.
Keep adjacent containers cool by spraying with water.

Special protective equipment for firefighters : Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures : Observe all relevant local and international regulations.
Notify authorities if any exposure to the general public or the environment occurs or is likely to occur.
Local authorities should be advised if significant spillages cannot be contained.
Isolate hazard area and deny entry to unnecessary or unprotected personnel.
Avoid contact with skin, eyes and clothing.
Be ready for fire or possible exposure.
Do not operate electrical equipment.
Stay upwind and out of low areas.

Environmental precautions : Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment.
Monitor area with combustible gas indicator.

Methods and materials for containment and cleaning up : For small liquid spills (< 1 drum), transfer by mechanical means to a labeled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely Remove contaminated soil and dispose of safely.
For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely

Additional advice : For guidance on selection of personal protective equipment see Chapter 8 of this Safety Data Sheet.
For guidance on disposal of spilled material see Chapter 13 of this Safety Data Sheet.

SECTION 7. HANDLING AND STORAGE

General Precautions : Avoid breathing of or direct contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Safety Data Sheet.
Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.
Ensure that all local regulations regarding handling and storage facilities are followed.

Advice on safe handling : Avoid inhaling vapour and/or mists.
Avoid contact with skin, eyes and clothing.
Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks.
The vapour is heavier than air. Beware of accumulation in pits and confined spaces.
Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols.
Bulk storage tanks should be diked (bunded).
Properly dispose of any contaminated rags or cleaning materials in order to prevent fires.
Even with proper grounding and bonding, this material can still accumulate an electrostatic charge.
If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.
Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges.
These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements.
These activities may lead to static discharge e.g. spark formation.
Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (≤ 1 m/s until fill pipe submerged to twice its diameter, then ≤ 7 m/s). Avoid splash filling.
Do NOT use compressed air for filling, discharging, or handling operations.
Inhibitor levels should be maintained.
Protect against light.

Avoidance of contact : Strong oxidising agents.
Copper alloys.

Product Transfer : If positive displacement pumps are used, these must be fitted with a non-integral pressure relief valve. Refer to guidance

under Handling section.

Storage

Conditions for safe storage	:	Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.
Other data	:	Storage Temperature: 25 °C / 77 °F maximum. Keep away from aerosols, flammables, oxidizing agents, corrosives and from other flammable products which are not harmful or toxic to man or to the environment. Must be stored in a diked (bunded) well- ventilated area, away from sunlight, ignition sources and other sources of heat. Must be kept inhibited during storage and shipment as material can polymerise. Vapours from tanks should not be released to atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable.
Packaging material	:	Suitable material: For container paints, use epoxy paint, zinc silicate paint., For containers, or container linings use mild steel, stainless steel. Unsuitable material: Copper., Copper alloys.
Container Advice	:	Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.
Specific use(s)	:	Not applicable Ensure that all local regulations regarding handling and storage facilities are followed. See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). IEC/TS 60079-32-1: Electrostatic hazards, guidance

SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
styrene	100-42-5	TWA	20 ppm 85 mg/m3	
	Further information: The value is provided by the Industry Association. This value is provided for information only.			
		TWA	20 ppm 85 mg/m3	CA AB OEL
		STEL	40 ppm 170 mg/m3	CA AB OEL
		TWA	50 ppm	CA BC OEL
		STEL	75 ppm	CA BC OEL
		TWA	35 ppm	CA ON OEL
		STEL	100 ppm	CA ON OEL
		STEV	100 ppm 426 mg/m3	CA QC OEL
		TWAEV	50 ppm 213 mg/m3	CA QC OEL
		TWA	20 ppm	ACGIH
		STEL	40 ppm	ACGIH

Biological occupational exposure limits

No biological limit allocated.

Monitoring Methods

Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory.
Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available.
National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/
Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous Substances http://www.hse.gov.uk/
Institut für Arbeitsschutz Deutschen Gesetzlichen Unfallversicherung (IFA) , Germany http://www.dguv.de/inhalt/index.jsp
L'Institut National de Recherche et de Securité, (INRS), France http://www.inrs.fr/accueil

Engineering measures : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include:

Use sealed systems as far as possible.
Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits.
Local exhaust ventilation is recommended.
Firewater monitors and deluge systems are recommended.
Eye washes and showers for emergency use.
Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.

General Information:
Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general/local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean/flush equipment, where possible, prior to maintenance. Where there is potential for exposure: restrict access to authorised persons; provide specific activity training to operators to minimise exposures; wear suitable gloves and coveralls to prevent skin contamination; wear respiratory protection when there is potential for inhalation; clear up spills immediately and dispose of wastes safely.Ensure safe systems of work or equivalent arrangements are in place to manage risks. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance.

Personal protective equipment

Respiratory protection : If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation.
Check with respiratory protective equipment suppliers.
Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.
Where air-filtering respirators are suitable, select an appropriate combination of mask and filter.
If air-filtering respirators are suitable for conditions of use:
Select a filter suitable for organic gases and vapours [Type A boiling point >65°C (149°F)].

Hand protection
Remarks : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection. Longer term protection: Viton.
Incidental contact/Splash protection: Nitrile rubber.
For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for >

480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognize that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time maybe acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Glove thickness should be typically greater than 0.35 mm depending on the glove make and model. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.

Eye protection : Wear goggles for use against liquids and gas.
Wear full face shield if splashes are likely to occur.

Skin and body protection : Wear chemical resistant gloves/gauntlets and boots. Where risk of splashing, also wear an apron.
Wear antistatic and flame retardant clothing, if a local risk assessment deems it so.

Protective measures : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
The following information, while appropriate for the product is general in nature. The selection of Personal Protective Equipment will vary depending on the conditions of use.

Hygiene measures : Wash hands before eating, drinking, smoking and using the toilet.
Launder contaminated clothing before re-use.

Environmental exposure controls

General advice : Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.
Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.
Information on accidental release measures are to be found in section 6.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Oily liquid.

Colour	:	Colourless to yellowish
Odour	:	Aromatic hydrocarbon
Odour Threshold	:	0.1 ppm
pH	:	Not applicable
Melting / freezing point	:	-31 °C / -24 °F
Boiling point	:	145 °C / 293 °F
Flash point	:	32 °C / 90 °F
Evaporation rate	:	12.4 Method: ASTM D 3539, nBuAc=1
Flammability (solid, gas)	:	Not applicable
Upper explosion limit	:	6.1 %(V)
Lower explosion limit	:	1.1 %(V)
Vapour pressure	:	670 Pa (20 °C / 68 °F)
Relative vapour density	:	3.6
Relative density	:	Data not available
Density	:	906 kg/m3 (20 °C / 68 °F)
Solubility(ies)		
Water solubility	:	0.29 kg/m3 (20 °C / 68 °F)
Partition coefficient: n-octanol/water	:	log Pow: 2.95
Auto-ignition temperature	:	490 °C / 914 °F
Decomposition temperature	:	Data not available
Viscosity		
Viscosity, dynamic	:	0.7 mPa.s (25 °C / 77 °F)
Viscosity, kinematic	:	Data not available
Explosive properties	:	Not applicable
Oxidizing properties	:	Not applicable

Self-heating substances	:	At high temperatures, for example fire conditions, exothermic polymerisation may occur causing possible container rupture., Dangerous polymerisation can occur on contact with highly catalytic surfaces., In case of contact with water the inhibitor concentration might decrease and cause polymerisation.
Surface tension	:	34 mN/m
Molecular weight	:	104.15 g/mol

SECTION 10. STABILITY AND REACTIVITY

Reactivity	:	Polymerises with risk of fire and explosion. Reacts with strong oxidising agents.
Chemical stability	:	Material is stable when properly inhibited and an appropriate dissolved oxygen level is maintained (see Storage in Chapter 7). Polymerises with risk of fire and explosion. Reacts with strong oxidising agents.
Possibility of hazardous reactions	:	Normally stable under ambient conditions and if properly inhibited.
Conditions to avoid	:	Heat, flames, and sparks. Exposure to sunlight. Exposure to air. In certain circumstances product can ignite due to static electricity.
Incompatible materials	:	Strong oxidising agents. Copper alloys.
Hazardous decomposition products	:	Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.

SECTION 11. TOXICOLOGICAL INFORMATION

Basis for assessment : Information given is based on product testing.

Information on likely routes of exposure
Inhalation is the primary route of exposure although absorption may occur through skin contact or following accidental ingestion.

Acute toxicity

Product:

Acute oral toxicity : LD50 (Rat): > 5,000 mg/kg
Remarks: Low toxicity:

Acute inhalation toxicity : LC50: >10 - <=20 mg/l
Remarks: Harmful if inhaled.

Acute dermal toxicity : LD50: > 5,000 mg/kg
Remarks: Expected to be of low toxicity:

Skin corrosion/irritation

Product:

Remarks: Causes skin irritation.

Serious eye damage/eye irritation

Product:

Remarks: Causes serious eye irritation.

Respiratory or skin sensitisation

Product:

Remarks: Not expected to be a sensitiser.

Germ cell mutagenicity

Product:

Genotoxicity in vivo : Remarks: Not considered a mutagenic hazard.

Carcinogenicity

Product:

Remarks: Not expected to be carcinogenic.
Styrene has been found to produce lung tumours in mice. These tumours are not considered to be relevant to humans.

IARC	Group 2B: Possibly carcinogenic to humans	
	styrene	100-42-5
OSHA	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.	
NTP	Reasonably anticipated to be a human carcinogen	
	styrene	100-42-5

Reproductive toxicity

Product:

Effects on fertility : Remarks: Not expected to be a developmental toxicant.
Causes foetotoxicity in animals at doses which are maternally toxic.
Not expected to impair fertility.

STOT - single exposure

Product:

Remarks: Inhalation of vapours or mists may cause irritation to the respiratory system.

STOT - repeated exposure

Product:

Remarks: Harmful: danger of serious damage to health by prolonged exposure through inhalation.
Can cause liver damage.
Repeated exposure affects the respiratory system.
Auditory system: prolonged and repeated exposures to high concentrations have resulted in hearing loss in rats.
Solvent abuse and noise interaction in the work environment may cause hearing loss.
Central nervous system: repeated exposure affects the nervous system.

Aspiration toxicity

Product:

Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.

Further information

Product:

Remarks: Classifications by other authorities under varying regulatory frameworks may exist.

SECTION 12. ECOLOGICAL INFORMATION

Basis for assessment : Ecotoxicological data are based on product testing.

Ecotoxicity

Product:

Toxicity to fish (Acute toxicity) : Remarks: Toxic:
LL/EL/IL50 > 1 <= 10 mg/l

Toxicity to crustacean (Acute toxicity)	:	Remarks: Toxic: LL/EL/IL50 > 1 <= 10 mg/l
Toxicity to algae/aquatic plants (Acute toxicity)	:	Remarks: Toxic: LL/EL/IL50 > 1 <= 10 mg/l
Toxicity to fish (Chronic toxicity)	:	Remarks: NOEC/NOEL expected to be > 0.1 - <= 1.0 mg/l (based on modeled data)
Toxicity to crustacean (Chronic toxicity)	:	Remarks: NOEC/NOEL > 1.0 - <=10 mg/l (based on test data)
Toxicity to microorganisms (Acute toxicity)	:	Remarks: Practically non toxic: LL/EL/IL50 > 100 mg/l

Persistence and degradability

Product:

Biodegradability	:	Remarks: Readily biodegradable. Oxidises rapidly by photo-chemical reactions in air.

Bioaccumulative potential

Product:

Bioaccumulation	:	Remarks: Not expected to bioaccumulate significantly.
Partition coefficient: n-octanol/water	:	log Pow: 2.95

Mobility in soil

Product:

Mobility	:	Remarks: Floats on water. If product enters soil, it will be highly mobile and may contaminate groundwater.

Other adverse effects

Product:

Additional ecological information	:	None known.

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the

toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.

Do not dispose into the environment, in drains or in water courses
Waste product should not be allowed to contaminate soil or water.

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 and must be complied with.

Contaminated packaging : Drain container thoroughly.
After draining, vent in a safe place away from sparks and fire.
Residues may cause an explosion hazard.
Do not puncture, cut, or weld uncleaned drums.
Send to drum recoverer or metal reclaimer.

SECTION 14. TRANSPORT INFORMATION

TDG

UN number	:	2055
Proper shipping name	:	STYRENE MONOMER, STABILIZED
Class	:	3
Packing group	:	III
Labels	:	3
Marine pollutant	:	no

International Regulations

IATA-DGR

UN/ID No.	:	UN 2055
Proper shipping name	:	STYRENE MONOMER, STABILIZED
Class	:	3
Packing group	:	III
Labels	:	3

IMDG-Code

UN number	:	UN 2055
Proper shipping name	:	STYRENE MONOMER, STABILIZED
Class	:	3
Packing group	:	III
Labels	:	3
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution category	:	Y
Ship type	:	3
Product name	:	Styrene monomer

Special precautions for user

Remarks : Special Precautions: Refer to Chapter 7, Handling & Storage, for special precautions which a user needs to be aware of or needs to comply with in connection with transport.

Additional Information **:** This product may be transported under nitrogen blanketing. Nitrogen is an odourless and invisible gas. Exposure to nitrogen enriched atmospheres displaces available oxygen which may cause asphyxiation or death. Personnel must observe strict safety precautions when involved with a confined space entry.

SECTION 15. REGULATORY INFORMATION

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

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.
This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (HPR) and the SDS contains all the information required by the HPR.

The components of this product are reported in the following inventories:

AICS : Listed

DSL : Listed

IECSC : Listed

ENCS : Listed

KECI : Listed

NZIoC : Listed

PICCS : Listed

CH INV : Listed

TSCA : Listed

SECTION 16. OTHER INFORMATION

Full text of other abbreviations

AICS - Australian Inventory of Chemical Substances; ANTT - National Agency for Transport by Land of Brazil; ASTM - American Society for the Testing of Materials; bw - Body weight; CMR - Carcinogen, Mutagen or Reproductive Toxicant; CPR - Controlled Products Regulations; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); 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; ERG - Emergency Response Guide; 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; Nch - Chilean Norm; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NOM - Official Mexican Norm; NTP - National Toxicology Program; 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; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; TCSI - Taiwan Chemical Substance Inventory; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act (United States); UN - United Nations; UNRTDG - United Nations Recommendations on the Transport of Dangerous Goods; vPvB - Very Persistent and Very Bioaccumulative; WHMIS - Workplace Hazardous Materials Information System

A vertical bar (|) in the left margin indicates an amendment from the previous version.
Due to the conversion of this product to GHS classification and labelling, there has been a significant change to the nature of the information presented in chapter 2.

Sources of key data used to compile the Safety Data Sheet : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

Revision Date : 2016-10-14

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

CA / EN

Inject 4.4
Crude Oil

SAFETY DATA SHEET

SECTION 1 IDENTIFICATION

PRODUCT

Product Name: **CRUDE OIL, SOUR**
Product Description: Petroleum Crude Oil
SDS Number: 3277

Intended Use: Feedstock

COMPANY IDENTIFICATION

Supplier: **Imperial Oil - Crude Oil Supply & Marketing**
P.O. Box 2480, Station M
Calgary, ALBERTA T2P 3M9 Canada

24 Hour Emergency Telephone	1-866-232-9563
Transportation Emergency Phone Number	1-866-232-9563
Supplier General Contact	1-800-567-3776

SECTION 2 HAZARD IDENTIFICATION

This material is considered to be hazardous according to regulatory guidelines.

This product has been classified in accordance with hazard criteria of the Hazardous Products Regulations (HPR) SOR/2015-17 and the SDS contains all the information required by the HPR SOR/2015-17.

CLASSIFICATION:

Flammable Liquids — Category 2
Eye Irritation — Category 2A
Carcinogenicity — Category 1B
Specific Target Organ Toxicity — Single Exposure (Central Nervous System) — Category 3
Specific Target Organ Toxicity — Repeated Exposure — Category 2
Aspiration Hazard — Category 1

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H225: Highly flammable liquid and vapour. H304: May be fatal if swallowed and enters airways. H319: Causes serious eye irritation. H336: May cause drowsiness or dizziness. H350: May cause cancer. H373: May cause damage to organs through prolonged or repeated exposure. Blood, Liver, Spleen, Thymus

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P233: Keep container tightly closed. P240: Ground and bond container and receiving equipment. P241: Use explosion-proof electrical, ventilating and lighting equipment. P242: Use non-sparking tools. P243: Take action to prevent static discharges. P260: Do not breathe mist / vapours. P264: Wash skin thoroughly after handling. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P308 + P313: IF exposed or concerned: Get medical advice/attention. P312: Call a POISON CENTER or doctor/physician if you feel unwell. P331: Do NOT induce vomiting. P337 + P313: If eye irritation persists: Get medical advice/attention. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish. P391: Collect spillage.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: Petroleum

Other hazard information:

Health Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

Physical Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an ignition. Material can release vapours that readily form flammable mixtures. Vapour accumulation could flash and/or explode if ignited.

HEALTH HAZARDS

Hydrogen sulphide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulphide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odour does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. Repeated exposure may cause skin dryness or cracking. May be irritating to nose, throat, and lungs. May cause central nervous system depression. Exposure to benzene is associated with cancer (acute myeloid leukaemia and myelodysplastic syndrome), damage to the blood-producing system, and serious blood disorders (see Section 11).

ENVIRONMENTAL HAZARDS

Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID:	Health:	2	Flammability:	3	Reactivity:	0
HMIS Hazard ID:	Health:	2*	Flammability:	3	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) in Hazardous product

Name	CAS#	Concentration*	GHS Hazard Codes
Petroleum	8002-05-9	100%	H225, H304, H336, H350(1B), H319(2A), H373, H401, H411

Hazardous Constituent(s) Contained in Complex Substance(s)

Name	CAS#	Concentration*	GHS Hazard Codes
benzene	71-43-2	1 - 5%	H225, H303, H304, H340(1B), H350(1A), H315, H319(2A), H372, H401, H412
cyclohexane	110-82-7	1 - 5%	H225, H304, H336, H315, H400(M factor 1), H410(M factor 1)
ethylbenzene	100-41-4	0.1 - 1%	H225, H304, H332, H373, H401, H412
hydrogen sulphide	7783-06-4	> 0.005 %	H220, H280, H330(2), H400(M factor 1)
n-hexane	110-54-3	1 - 5%	H225, H304, H336, H361(F), H315, H373, H401, H411
naphthalene	91-20-3	1 - 5%	H228(2), H302, H351, H400(M factor 1), H410(M factor 1)
toluene	108-88-3	1 - 5%	H225, H304, H336, H361(D), H315, H373, H401, H412
xylene	1330-20-7	1 - 5%	H226, H303, H304, H312, H332, H335, H315, H320(2B), H373, H401, H412

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4 FIRST-AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing

assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately. This material, or a component, may be associated with cardiac sensitization following very high exposures (well above occupational exposure limits) or with concurrent exposure to high stress levels or heart-stimulating substances like epinephrine. Administration of such substances should be avoided.

SECTION 5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. If a leak or spill has not ignited, use water spray to disperse the vapours and to protect personnel attempting to stop a leak. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Highly flammable. Vapour is flammable and heavier than air. Vapour may travel across the ground and reach remote ignition sources, causing a flashback fire danger. Exposure to fire can generate toxic fumes. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Hydrogen sulphide, Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulphur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: <21°C (70°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D

Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required, due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: half-face or full-face respirator with filter(s) for organic vapor and, when applicable, H2S, or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Chemical goggles are recommended if splashes or contact with eyes is possible. Work gloves that are resistant to aromatic hydrocarbons are recommended. If contact with hot product is possible or anticipated, gloves should be heat-resistant and thermally insulated. Note: gloves made of PVA are not water-resistant, and are not suitable for emergency use. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic and, if necessary, heat resistant and thermal insulated material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapour-suppressing foam may be used to reduce vapour. Large Spills: Water spray may reduce vapour, but may not prevent ignition in enclosed spaces.

Water Spill: Stop leak if you can do so without risk. Eliminate sources of ignition. Warn other shipping. If the Flash Point exceeds the Ambient Temperature by 10 deg C or more, use containment booms and remove from the surface by skimming or with suitable absorbents when conditions permit. If the Flash Point does not exceed the Ambient Air Temperature by at least 10C, use booms as a barrier to protect shorelines and allow material to evaporate. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

H2S is present. Avoid all personal contact. Crude oils can contain trace levels of natural impurities including heavy metals, such as mercury, nickel or lead, as well as naturally occurring radioactive material. As the impurity content may concentrate during refining/processing, process operations, including equipment, materials and products should be evaluated to identify and manage any potential risks to health, safety or the environment or regulatory concerns.

Prevent exposure to ignition sources, for example use non-sparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapour may be evolved from heated or agitated material. Use only with adequate ventilation. Do not enter storage areas or confined spaces unless adequately ventilated. The toxic and olfactory (sense of smell) fatigue properties of hydrogen sulfide require that air monitoring alarms and respiratory protection be used where the concentration might be expected to reach a harmful level, such as in an enclosed space, heated transport vessel, or in a spill or leak situation.

Material may contain trace amounts of naturally occurring radioactive material (NORM), which will accumulate in process equipment and storage vessels. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.

STORAGE

Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. The type of container used to store the material may affect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Outside or detached storage preferred. Storage containers should be earthed and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Substance Name	Form	Limit/Standard			Note	Source
benzene		STEL	1 ppm			Supplier
benzene		TWA	0.5 ppm			Supplier
benzene		STEL	2.5 ppm		Skin	ACGIH
benzene		TWA	0.5 ppm		Skin	ACGIH
cyclohexane		TWA	100 ppm			ACGIH

ethylbenzene		TWA	20 ppm			ACGIH
hydrogen sulphide		STEL	14 mg/m3	10 ppm		Supplier
hydrogen sulphide		TWA	7 mg/m3	5 ppm		Supplier
hydrogen sulphide		STEL	5 ppm			ACGIH
hydrogen sulphide		TWA	1 ppm			ACGIH
n-hexane		TWA	50 ppm		Skin	ACGIH
naphthalene		TWA	10 ppm		Skin	ACGIH
toluene		TWA	20 ppm			ACGIH
xylene		STEL	150 ppm			ACGIH
xylene		TWA	100 ppm			ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapours may accumulate.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: Chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or

manufacturer data. The types of clothing to be considered for this material include:
Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Dark Brown
Odour: Rotten Egg
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.661 - 1.013
Flammability (Solid, Gas): N/A
Flash Point [Method]: <21°C (70°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: 32°C (90°F) - 37°C (99°F)
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: 0 kPa (0 mm Hg) at 20°C - 106.4 kPa (800 mm Hg) at 20ºC
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: >0.42 cSt (0.42 mm2/sec) at 40ºC
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -73°C (-100°F) - 48°C (118°F)

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Not determined.
Irritation: No end point data for material.	Elevated temperatures or mechanical action may form vapours, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.
Ingestion	
Acute Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 402
Skin Corrosion/Irritation: Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation: Data available.	Irritating and will injure eye tissue. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: Data available.	Not expected to be a skin sensitizer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 406
Aspiration: Data available.	May be fatal if swallowed and enters airways. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: Data available.	Not expected to be a germ cell mutagen. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 471 474 479
Carcinogenicity: Data available.	Caused cancer in laboratory animals. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 451
Reproductive Toxicity: Data available.	Not expected to be a reproductive toxicant. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 414 421
Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	

Single Exposure: Data available.	May cause drowsiness or dizziness. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401 402
Repeated Exposure: Data available.	Concentrated, prolonged or deliberate exposure may cause organ damage. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 411

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
ethylbenzene	Inhalation Lethality: 4 hour(s) LC50 17.8 mg/l (Vapour) (Rat); Oral Lethality: LD 50 3.5 g/kg (Rat)
hydrogen sulphide	Inhalation Lethality: 4 hour(s) LC50 444 ppm (Gas) (Rat)
naphthalene	Inhalation Lethality: 4 hour(s) LC50 > 0.4 mg/l (Max attainable vapor conc.) (Rat); Oral Lethality: LD 50 533 mg/kg (Mouse)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Blood, Liver, Spleen, Thymus

Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema. Exposure to this material, or one of its components, in situations where there is the potential for high levels, such as in confined spaces or with abuse, may result in abnormal heart rhythm (arrhythmia). High-level exposure to hydrocarbons (above occupational exposure limits) may initiate arrhythmia in a worker that is undergoing stress or is taking a heart-stimulating substance such as epinephrine, a nasal decongestant, or an asthma or cardiovascular drug.
Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone marrow.

Contains:
BENZENE: Caused cancer (acute myeloid leukemia and myelodysplastic syndrome), damage to the blood-producing system, and serious blood disorders in human studies. Caused genetic effects and effects on the immune system in laboratory animal and some human studies. Caused toxicity to the fetus and cancer in laboratory animal studies. HYDROGEN SULPHIDE: Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage. NAPHTHALENE: Exposure to high concentrations of naphthalene may cause destruction of red blood cells, anemia, and cataracts. Naphthalene caused cancer in laboratory animal studies, but the relevance of these findings to humans is uncertain.
N-HEXANE: Prolonged and/or repeated exposures to n-Hexane can cause progressive and potentially irreversible damage to the peripheral nervous system (e.g. fingers, feet, arms, legs, etc.). Simultaneous exposure to Methyl Ethyl Ketone (MEK) or Methyl Isobutyl Ketone (MIBK) and n-Hexane can potentiate the risk of adverse effects from n-Hexane on the peripheral nervous system. n-Hexane has been shown to cause testicular damage at high doses in male rats. The relevance of this effect for humans is unknown. TOLUENE : Concentrated, prolonged or deliberate inhalation may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals (> 1500 ppm)

have been reported to cause adverse fetal developmental effects. ETHYLBENZENE: Caused cancer in laboratory animal studies. The relevance of these findings to humans is uncertain.

CMR Status:

Chemical Name	CAS Number	List Citations
benzene	71-43-2	1, 4, 5
cyclohexane	110-82-7	4
ethylbenzene	100-41-4	3, 4
hydrogen sulphide	7783-06-4	4
n-hexane	110-54-3	4
naphthalene	91-20-3	3, 4
toluene	108-88-3	4
xylene	1330-20-7	4

--REGULATORY LISTS SEARCHED--

1 = IARC 1
2 = IARC 2A
3 = IARC 2B
4 = ACGIH ALL
5 = ACGIH A1
6 = ACGIH A2

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Low molecular wt. component -- Expected to be inherently biodegradable
High molecular wt. component -- Expected to biodegrade slowly.

Photolysis:

More water soluble component -- Expected to degrade at a moderate rate in water when exposed to sunlight.

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Components -- Has the potential to bioaccumulate.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	48 hour(s)	Invertebrate	EC50 10 - 100 mg/l: data for similar materials

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (TDG)

Proper Shipping Name: PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Hazard Class & Division: 3 (6.1)
UN Number: 3494
Packing Group: I
Special Provisions: 106, 150

Footnote: If shipped over water, product TDG classification as shown below for SEA (IMDG).

LAND (DOT)

Proper Shipping Name: PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Hazard Class & Division: 3
ID Number: 3494
Packing Group: I

Marine Pollutant: No
ERG Number: 131
Label(s): 3 (6.1)
Transport Document Name: UN3494, PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC, 3 (6.1), PG I

SEA (IMDG)

Proper Shipping Name: PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Hazard Class & Division: 3
EMS Number: F-E, S-E
UN Number: 3494
Packing Group: I
Marine Pollutant: Yes
Label(s): 3 (6.1)
Transport Document Name: UN3494, PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC, 3 (6.1), PG I, (21°C c.c.), MARINE POLLUTANT

AIR (IATA)

Proper Shipping Name: PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC
Hazard Class & Division: 3
UN Number: 3494
Packing Group: I
Label(s) / Mark(s): 3 (6.1)
Transportation Limitations: CARGO AIRCRAFT ONLY
Transport Document Name: UN3494, PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC, 3, PG I, (6.1)

SECTION 15 REGULATORY INFORMATION

CEPA: All components of this product are either on the Domestic Substance List (DSL) or are exempt.

Listed or exempt from listing/notification on the following chemical inventories (May contain substance(s) subject to notification to the EPA Active TSCA inventory prior to import to USA): AICS, DSL, ENCS, IECSC, KECI, PICCS, TSCA

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
benzene	71-43-2	6
cyclohexane	110-82-7	6
n-hexane	110-54-3	6
naphthalene	91-20-3	6

toluene	108-88-3	6
xylene	1330-20-7	6

--REGULATORY LISTS SEARCHED--

1 = TSCA 4	3 = TSCA 5e	5 = TSCA 12b
2 = TSCA 5a2	4 = TSCA 6	6 = NPRI

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H220: Extremely flammable gas; Flammable Gas, Cat 1
H225: Highly flammable liquid and vapor; Flammable Liquid, Cat 2
H226: Flammable liquid and vapour; Flammable Liquid, Cat 3
H280: Contains gas under pressure; may explode if heated; Pressurized Gas
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H303: May be harmful if swallowed; Acute Tox Oral, Cat 5
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
H312: Harmful in contact with skin; Acute Tox Dermal, Cat 4
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H319(2A): Causes serious eye irritation; Serious Eye Damage/Irr, Cat 2A
H320(2B): Causes eye irritation; Serious Eye Damage/Irr, Cat 2B
H330(2): Fatal if inhaled; Acute Tox Inh, Cat 2
H332: Harmful if inhaled; Acute Tox Inh, Cat 4
H335: May cause respiratory irritation; Target Organ Single, Resp Irr
H336: May cause drowsiness or dizziness; Target Organ Single, Narcotic
H340(1B): May cause genetic defects; Germ Cell Mutagenicity, Cat 1B
H350(1A): May cause cancer; Carcinogenicity, Cat 1A
H350(1B): May cause cancer; Carcinogenicity, Cat 1B
H351: Suspected of causing cancer; GHS Carcinogenicity, Cat 2
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H372: Causes damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 1
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1
H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2
H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Updates made in accordance with implementation of GHS requirements.

THIS SDS COVERS THE FOLLOWING MATERIALS: BONNIE GLEN SOUR | BOUNDARY LAKE | BP SOUR HEAVY | CENTRAL ALBERTA | CONVENTIONAL HEAVY | DRAYTON VALLEY SOUR | EDMONTON HIGH SOUR | EDMONTON LOW SOUR | ELBOW CENTRAL ALBERTA | FOSTERTON HVY |

HARDISTY LT | LLOYD GIBSON | LT SOUR BLEND <LSB> | MACKAY RIVER HEAVY | MEDIUM SOUR BLEND | MID-SASK LT | MIDALE | MILK RIVER SOUR | MIXED SOUR BLEND | MOOSE JAW TOPS (MJT) | NEXUS HEAVY SOUR | NEXUS LIGHT SOUR | ONT. SOUR | PEACE HEAVY | PEACE SOUR | PREMIUM CONVENTIONAL HEAVY | RANGELAND LT SOUR | REDWATER | SEAL HEAVY | VIRDEN LT | VIRDEN MED | WASKADA SOUR | WEST TEXAS/NEW MEXICO SOUR | WESTSPUR LT | WESTSPUR MIDALE

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SAFETY DATA SHEET

SECTION 1 IDENTIFICATION

PRODUCT

Product Name: **CRUDE OIL, SWEET**
Product Description: Petroleum Crude Oil
SDS Number: 21341

Intended Use: Feedstock

COMPANY IDENTIFICATION

Supplier: **Imperial Oil - Crude Oil Supply & Marketing**
P.O. Box 2480, Station M
Calgary, ALBERTA T2P 3M9 Canada

24 Hour Emergency Telephone	1-866-232-9563
Transportation Emergency Phone Number	1-866-232-9563
Supplier General Contact	1-800-567-3776

SECTION 2 HAZARD IDENTIFICATION

This material is considered to be hazardous according to regulatory guidelines.

This product has been classified in accordance with hazard criteria of the Hazardous Products Regulations (HPR) SOR/2015-17 and the SDS contains all the information required by the HPR SOR/2015-17.

CLASSIFICATION:

Flammable Liquids — Category 2
Eye Irritation — Category 2A
Carcinogenicity — Category 1B
Specific Target Organ Toxicity — Single Exposure (Central Nervous System) — Category 3
Specific Target Organ Toxicity — Repeated Exposure — Category 2
Aspiration Hazard — Category 1

LABEL:
Pictogram:

Signal Word: Danger

Hazard Statements:
H225: Highly flammable liquid and vapour. H304: May be fatal if swallowed and enters airways. H319: Causes serious eye irritation. H336: May cause drowsiness or dizziness. H350: May cause cancer. H373: May cause damage to organs through prolonged or repeated exposure. Blood, Liver, Spleen, Thymus

Precautionary Statements:
P201: Obtain special instructions before use. P202: Do not handle until all safety precautions have been read and understood. P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P233: Keep container tightly closed. P240: Ground and bond container and receiving equipment. P241: Use explosion-proof electrical, ventilating and lighting equipment. P242: Use non-sparking tools. P243: Take action to prevent static discharges. P260: Do not breathe mist / vapours. P264: Wash skin thoroughly after handling. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. P303 + P361 + P353: IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. P304 + P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P308 + P313: IF exposed or concerned: Get medical advice/attention. P312: Call a POISON CENTER or doctor/physician if you feel unwell. P331: Do NOT induce vomiting. P337 + P313: If eye irritation persists: Get medical advice/attention. P370 + P378: In case of fire: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish. P391: Collect spillage.P403 + P235: Store in a well-ventilated place. Keep cool. P405: Store locked up.P501: Dispose of contents and container in accordance with local regulations.

Contains: PETROLEUM CRUDE OIL

Other hazard information:

Health Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

Physical Hazards Not Otherwise Classified: None as defined under HPR SOR/2015-17.

PHYSICAL / CHEMICAL HAZARDS

Material can accumulate static charges which may cause an ignition. Material can release vapours that readily form flammable mixtures. Vapour accumulation could flash and/or explode if ignited.

HEALTH HAZARDS

High-pressure injection under skin may cause serious damage. Hydrogen sulphide, a highly toxic gas, is expected to be present. Signs and symptoms of overexposure to hydrogen sulphide include respiratory and eye irritation, dizziness, nausea, coughing, a sensation of dryness and pain in the nose, and loss of consciousness. Odour does not provide a reliable indicator of the presence of hazardous levels in the atmosphere. Repeated exposure may cause skin dryness or cracking. May be irritating to the skin, nose, throat, and lungs. May cause central nervous system depression. Exposure to benzene is associated with cancer (acute myeloid leukaemia and myelodysplastic syndrome), damage to the blood-producing system, and

serious blood disorders (see Section 11).

ENVIRONMENTAL HAZARDS

Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

NFPA Hazard ID:	Health:	2	Flammability:	3	Reactivity:	0
HMIS Hazard ID:	Health:	2*	Flammability:	3	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a complex substance.

Hazardous Substance(s) or Complex Substance(s) in Hazardous product

Name	CAS#	Concentration*	GHS Hazard Codes
PETROLEUM CRUDE OIL	8002-05-9	100%	H225, H304, H336, H350(1B), H319(2A), H373, H401, H411

Hazardous Constituent(s) Contained in Complex Substance(s)

Name	CAS#	Concentration*	GHS Hazard Codes
Benzene	71-43-2	0.1 - < 1%	H225, H303, H304, H340(1B), H350(1A), H315, H319(2A), H372, H401
CYCLOHEXANE	110-82-7	1 - < 5%	H225, H304, H336, H315, H400(M factor 1), H410(M factor 1)
HYDROGEN SULPHIDE	7783-06-4	0.002 - 0.005%	H220, H280, H330(2), H400(M factor 1)
n-Hexane	110-54-3	1 - < 5%	H225, H304, H336, H361(F), H315, H373, H401, H411
Naphthalene	91-20-3	1 - < 5%	H228(2), H302, H351, H400(M factor 1), H410(M factor 1)
Toluene	108-88-3	1 - < 5%	H225, H304, H336, H361(D), H315, H373, H401, H412
XYLENES	1330-20-7	1 - < 5%	H226, H303, H304, H312, H332, H335, H315, H320(2B), H373, H401, H412

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4 FIRST-AID MEASURES

INHALATION

Immediately remove from further exposure. Get immediate medical assistance. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. Give supplemental

oxygen, if available. If breathing has stopped, assist ventilation with a mechanical device.

SKIN CONTACT

Remove contaminated clothing. Dry wipe exposed skin and cleanse with waterless hand cleaner and follow by washing thoroughly with soap and water. For those providing assistance, avoid further skin contact to yourself or others. Wear impervious gloves. Launder contaminated clothing separately before reuse. Discard contaminated articles that cannot be laundered. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury. For hot product: Immediately immerse in or flush affected area with large amounts of cold water to dissipate heat. Cover with clean cotton sheeting or gauze and get prompt medical attention.

EYE CONTACT

Flush thoroughly with water for at least 15 minutes. Get medical assistance.

INGESTION

Seek immediate medical attention. Do not induce vomiting.

NOTE TO PHYSICIAN

If ingested, material may be aspirated into the lungs and cause chemical pneumonitis. Treat appropriately. This material, or a component, may be associated with cardiac sensitization following very high exposures (well above occupational exposure limits) or with concurrent exposure to high stress levels or heart-stimulating substances like epinephrine. Administration of such substances should be avoided.

SECTION 5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. If a leak or spill has not ignited, use water spray to disperse the vapours and to protect personnel attempting to stop a leak. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Extremely Flammable. Vapour is flammable and heavier than air. Vapour may travel across the ground and reach remote ignition sources, causing a flashback fire danger. Exposure to fire can generate toxic fumes. Hazardous material. Firefighters should consider protective equipment indicated in Section 8.

Hazardous Combustion Products: Hydrogen sulphide, Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulphur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: -20°C (-4°F) - 35°C (95°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required, due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

For emergency responders: Respiratory protection: half-face or full-face respirator with filter(s) for organic vapor and, when applicable, H2S, or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Chemical goggles are recommended if splashes or contact with eyes is possible. Work gloves that are resistant to aromatic hydrocarbons are recommended. If contact with hot product is possible or anticipated, gloves should be heat-resistant and thermally insulated. Note: gloves made of PVA are not water-resistant, and are not suitable for emergency use. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic and, if necessary, heat resistant and thermal insulated material is recommended.

SPILL MANAGEMENT

Land Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Prevent entry into waterways, sewer, basements or confined areas. A vapour-suppressing foam may be used to reduce vapour. Use clean non-sparking tools to collect absorbed material. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Large Spills: Water spray may reduce vapour, but may not prevent ignition in enclosed spaces.

Water Spill: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do so without risk. Do not confine in area of spill. Advise occupants and shipping in downwind areas of fire and explosion hazard and warn them to stay clear. Warn other shipping. Allow liquid to evaporate from the surface. Remove from the surface by skimming or with suitable absorbents. If permitted by regulatory authorities, the use of suitable dispersants should be considered where permitted in local oil spill contingency plans. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Use booms as a barrier to protect shorelines. Use containment booms when the ambient temperature is below the flash point of the material. Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

H2S is present. Avoid all personal contact. Crude oils can contain trace levels of natural impurities including heavy metals, such as mercury, nickel or lead, as well as naturally occurring radioactive material. As the impurity content may concentrate during refining/processing, process operations, including equipment, materials and products should be evaluated to identify and manage any potential risks to health, safety or the environment or regulatory concerns.

Prevent exposure to ignition sources, for example use non-sparking tools and explosion-proof equipment. Potentially toxic/irritating fumes/vapour may be evolved from heated or agitated material. Use only with adequate ventilation. Do not enter storage areas or confined spaces unless adequately ventilated. The toxic and olfactory (sense of smell) fatigue properties of hydrogen sulfide require that air monitoring alarms and respiratory protection be used where the concentration might be expected to reach a harmful level, such as in an enclosed space, heated transport vessel, or in a spill or leak situation.

Material may contain trace amounts of naturally occurring radioactive material (NORM), which will accumulate in process equipment and storage vessels. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). Use proper bonding and/or ground procedures. However, bonding and grounds may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator. A liquid is typically considered a nonconductive, static accumulator if its conductivity is below 100 pS/m (100x10E-12 Siemens per meter) and is considered a semiconductive, static accumulator if its conductivity is below 10,000 pS/m. Whether a liquid is nonconductive or semiconductive, the precautions are the same. A number of factors, for example liquid temperature, presence of contaminants, anti-static additives and filtration can greatly influence the conductivity of a liquid.

STORAGE

Ample fire water supply should be available. A fixed sprinkler/deluge system is recommended. The type of container used to store the material may affect static accumulation and dissipation. Keep container closed. Handle containers with care. Open slowly in order to control possible pressure release. Store in a cool, well-ventilated area. Outside or detached storage preferred. Storage containers should be earthed and bonded. Fixed storage containers, transfer containers and associated equipment should be grounded and bonded to prevent accumulation of static charge.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT VALUES

Substance Name	Form	Limit/Standard			Note	Source
Benzene		STEL	1 ppm			Supplier
Benzene		TWA	0.5 ppm			Supplier

Benzene		STEL	2.5 ppm		Skin	ACGIH
Benzene		TWA	0.5 ppm		Skin	ACGIH
CYCLOHEXANE		TWA	100 ppm			ACGIH
HYDROGEN SULPHIDE		STEL	14 mg/m3	10 ppm		Supplier
HYDROGEN SULPHIDE		TWA	7 mg/m3	5 ppm		Supplier
HYDROGEN SULPHIDE		STEL	5 ppm			ACGIH
HYDROGEN SULPHIDE		TWA	1 ppm			ACGIH
n-Hexane		TWA	50 ppm		Skin	ACGIH
Naphthalene		TWA	10 ppm		Skin	ACGIH
Toluene		TWA	20 ppm			ACGIH
XYLENES		STEL	150 ppm			ACGIH
XYLENES		TWA	100 ppm			ACGIH

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

Use explosion-proof ventilation equipment to stay below exposure limits.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

Positive-pressure, air-supplied respirator in areas where H2S vapours may accumulate.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: Chemical goggles are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid
Colour: Dark Brown
Odour: Rotten Egg
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.661 - 1.013
Flammability (Solid, Gas): N/A
Flash Point [Method]: -20°C (-4°F) - 35°C (95°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: >= 20°C (68°F)
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: 0 kPa (0 mm Hg) at 20°C - 106.4 kPa (800 mm Hg) at 20ºC
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: <7 cSt (7 mm2/sec) at 40ºC
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: < 32°C (90°F)

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Avoid heat, sparks, open flames and other ignition sources.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Not determined.
Irritation: No end point data for material.	Elevated temperatures or mechanical action may form vapours, mist, or fumes which may be irritating to the eyes, nose, throat, or lungs.
Ingestion	
Acute Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401
Skin	
Acute Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 402
Skin Corrosion/Irritation: Data available.	May dry the skin leading to discomfort and dermatitis. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 404
Eye	
Serious Eye Damage/Irritation: Data available.	Irritating and will injure eye tissue. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 405
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: Data available.	Not expected to be a skin sensitizer. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 406
Aspiration: Data available.	May be fatal if swallowed and enters airways. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: Data available.	Not expected to be a germ cell mutagen. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 471 474 479
Carcinogenicity: Data available.	Caused cancer in laboratory animals. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 451
Reproductive Toxicity: Data available.	Not expected to be a reproductive toxicant. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 414 421

Lactation: No end point data for material.	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: Data available.	May cause drowsiness or dizziness. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 401 402
Repeated Exposure: Data available.	Concentrated, prolonged or deliberate exposure may cause organ damage. Based on test data for structurally similar materials. Test(s) equivalent or similar to OECD Guideline 411

TOXICITY FOR SUBSTANCES

NAME	ACUTE TOXICITY
HYDROGEN SULPHIDE	Inhalation Lethality: 4 hour(s) LC50 444 ppm (Gas) (Rat)
Naphthalene	Inhalation Lethality: 4 hour(s) LC50 > 0.4 mg/l (Max attainable vapor conc.) (Rat); Oral Lethality: LD 50 533 mg/kg (Mouse)

OTHER INFORMATION

For the product itself:

Target Organs Repeated Exposure: Blood, Liver, Spleen, Thymus

Vapour/aerosol concentrations above recommended exposure levels are irritating to the eyes and respiratory tract, may cause headaches, dizziness, anaesthesia, drowsiness, unconsciousness and other central nervous system effects including death. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion and blurred vision) and/or damage. Small amounts of liquid aspirated into the lungs during ingestion or from vomiting may cause chemical pneumonitis or pulmonary edema. Exposure to this material, or one of its components, in situations where there is the potential for high levels, such as in confined spaces or with abuse, may result in abnormal heart rhythm (arrhythmia). High-level exposure to hydrocarbons (above occupational exposure limits) may initiate arrhythmia in a worker that is undergoing stress or is taking a heart-stimulating substance such as epinephrine, a nasal decongestant, or an asthma or cardiovascular drug.
Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone marrow.

Contains:
BENZENE: Caused cancer (acute myeloid leukemia and myelodysplastic syndrome), damage to the blood-producing system, and serious blood disorders in human studies. Caused genetic effects and effects on the immune system in laboratory animal and some human studies. Caused toxicity to the fetus and cancer in laboratory animal studies.
Crude oil: Contains polycyclic aromatic compounds (PACs). Prolonged and / or repeated exposure by skin or inhalation of certain PACs may cause cancer of the skin, lung, and of other sites of the body. In animal studies, some crudes produced skin tumors in mice, while other crudes produced no tumors. Developmental studies of crude oil in lab animals showed reduced fetal weight and increased fetal resorptions at maternally toxic levels. Repeated dermal exposure to crude oils in rats resulted in toxicity to the blood, liver, thymus, and bone marrow.
HYDROGEN SULPHIDE: Chronic health effects due to repeated exposures to low levels of H2S have not been established. High level (700 ppm) acute exposure can result in sudden death. High concentrations will lead to cardiopulmonary arrest due to nervous system toxicity and pulmonary edema. Lower levels (150 ppm) may overwhelm sense of smell, eliminating warning of exposure. Symptoms of overexposure to H2S include headache, fatigue, insomnia, irritability, and gastrointestinal problems. Repeated exposures to approximately 25 ppm will irritate mucous membranes and the respiratory system and have been implicated in some eye damage. NAPHTHALENE: Exposure to high concentrations of naphthalene may cause destruction of red blood cells, anemia, and cataracts. Naphthalene

caused cancer in laboratory animal studies, but the relevance of these findings to humans is uncertain.
N-HEXANE: Prolonged and/or repeated exposures to n-Hexane can cause progressive and potentially irreversible damage to the peripheral nervous system (e.g. fingers, feet, arms, legs, etc.). Simultaneous exposure to Methyl Ethyl Ketone (MEK) or Methyl Isobutyl Ketone (MIBK) and n-Hexane can potentiate the risk of adverse effects from n-Hexane on the peripheral nervous system. n-Hexane has been shown to cause testicular damage at high doses in male rats. The relevance of this effect for humans is unknown. TOLUENE : Concentrated, prolonged or deliberate inhalation may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals (> 1500 ppm) have been reported to cause adverse fetal developmental effects. ETHYLBENZENE: Caused cancer in laboratory animal studies. The relevance of these findings to humans is uncertain.

CMR Status:

Chemical Name	CAS Number	List Citations
Benzene	71-43-2	1, 4, 5
CYCLOHEXANE	110-82-7	4
ETHYL BENZENE	100-41-4	3, 4
HYDROGEN SULPHIDE	7783-06-4	4
n-Hexane	110-54-3	4
Naphthalene	91-20-3	3, 4
Toluene	108-88-3	4
XYLENES	1330-20-7	4

--REGULATORY LISTS SEARCHED--

1 = IARC 1
2 = IARC 2A
3 = IARC 2B
4 = ACGIH ALL
5 = ACGIH A1
6 = ACGIH A2

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Expected to be toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

MOBILITY

More volatile component -- Highly volatile, will partition rapidly to air. Not expected to partition to sediment and wastewater solids.

Less volatile component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Low molecular wt. component -- Expected to be inherently biodegradable

High molecular wt. component -- Expected to biodegrade slowly.

Photolysis:

More water soluble component -- Expected to degrade at a moderate rate in water when exposed to sunlight.

Atmospheric Oxidation:

More volatile component -- Expected to degrade rapidly in air

BIOACCUMULATION POTENTIAL

Components -- Has the potential to bioaccumulate.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	48 hour(s)	Invertebrate	EC50 10 - 100 mg/l: data for similar materials

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (TDG)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
UN Number: 1267
Packing Group: I
Special Provisions: 92,106,150

LAND (DOT)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
ID Number: 1267
Packing Group: I
ERG Number: 128
Label(s): 3
Transport Document Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

SEA (IMDG)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
EMS Number: F-E, S-E
UN Number: 1267
Packing Group: I
Marine Pollutant: Yes
Label(s): 3
Transport Document Name:

AIR (IATA)

Proper Shipping Name: PETROLEUM CRUDE OIL
Hazard Class & Division: 3
UN Number: 1267
Packing Group: I
Label(s) / Mark(s): 3
Transport Document Name: UN1267, PETROLEUM CRUDE OIL, 3, PG I

SECTION 15 REGULATORY INFORMATION

CEPA: All components of this product are either on the Domestic Substance List (DSL) or are exempt.

Listed or exempt from listing/notification on the following chemical inventories (May contain substance(s) subject to notification to the EPA Active TSCA inventory prior to import to USA): AICS, DSL, ENCS, IECSC, KECI, PICCS, TSCA

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
CYCLOHEXANE	110-82-7	6
n-Hexane	110-54-3	6
Naphthalene	91-20-3	6
Toluene	108-88-3	6

XYLENES	1330-20-7	6

--REGULATORY LISTS SEARCHED--

1 = TSCA 4	3 = TSCA 5e	5 = TSCA 12b
2 = TSCA 5a2	4 = TSCA 6	6 = NPRI

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H220: Extremely flammable gas; Flammable Gas, Cat 1
H225: Highly flammable liquid and vapor; Flammable Liquid, Cat 2
H226: Flammable liquid and vapour; Flammable Liquid, Cat 3
H280: Contains gas under pressure; may explode if heated; Pressurized Gas
H302: Harmful if swallowed; Acute Tox Oral, Cat 4
H303: May be harmful if swallowed; Acute Tox Oral, Cat 5
H304: May be fatal if swallowed and enters airways; Aspiration, Cat 1
H312: Harmful in contact with skin; Acute Tox Dermal, Cat 4
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H319(2A): Causes serious eye irritation; Serious Eye Damage/Irr, Cat 2A
H320(2B): Causes eye irritation; Serious Eye Damage/Irr, Cat 2B
H330(2): Fatal if inhaled; Acute Tox Inh, Cat 2
H332: Harmful if inhaled; Acute Tox Inh, Cat 4
H335: May cause respiratory irritation; Target Organ Single, Resp Irr
H336: May cause drowsiness or dizziness; Target Organ Single, Narcotic
H340(1B): May cause genetic defects; Germ Cell Mutagenicity, Cat 1B
H350(1A): May cause cancer; Carcinogenicity, Cat 1A
H350(1B): May cause cancer; Carcinogenicity, Cat 1B
H351: Suspected of causing cancer; GHS Carcinogenicity, Cat 2
H361(D): Suspected of damaging the unborn child; Repro Tox, Cat 2 (Develop)
H361(F): Suspected of damaging fertility; Repro Tox, Cat 2 (Fertility)
H372: Causes damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 1
H373: May cause damage to organs through prolonged or repeated exposure; Target Organ, Repeated, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H401: Toxic to aquatic life; Acute Env Tox, Cat 2
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1
H411: Toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 2
H412: Harmful to aquatic life with long lasting effects; Chronic Env Tox, Cat 3

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Updates made in accordance with implementation of GHS requirements.

THIS SDS COVERS THE FOLLOWING MATERIALS: BAKKEN SASKATCHEWAN | BC LT | BONNIE GLEN SWEET | DRAYTON VALLEY SWEET | GIBSONS MIXED BLEND SWEET-HARDISTY | KOCH SWEET BLEND | MIXED BLEND SWEET | NEXUS SWEET | NORMAN WELLS | ONT. SWEET | PEACE SWEET | RAINBOW | RANGELAND LT SWEET | SWAN HILLS | TERRA NOVA | WTI LIGHT

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Inject 5
CP Damage Assessment Forms

Tank Car Damage and Inspection Form

Completed By: _____ Waybill # _____

Date: _____ Time: _____

Car Number _____

Type of Car: ☐ Low Pressure ☐ Cryogenic ☐ Pressure ☐ Other

Specification #: _____ ☐ Picture Taken

Capacity: _____ ☐ Picture Taken

UN #: _____ ☐ Picture Taken

Jacketed: ☐ Y ☐ N

Insulated: ☐ Y ☐ N

Material: _____

Test Pressure: _____ ☐ Picture Taken

Build Date _____ ☐ Picture Taken

Construction Materials: _____

Type: _____

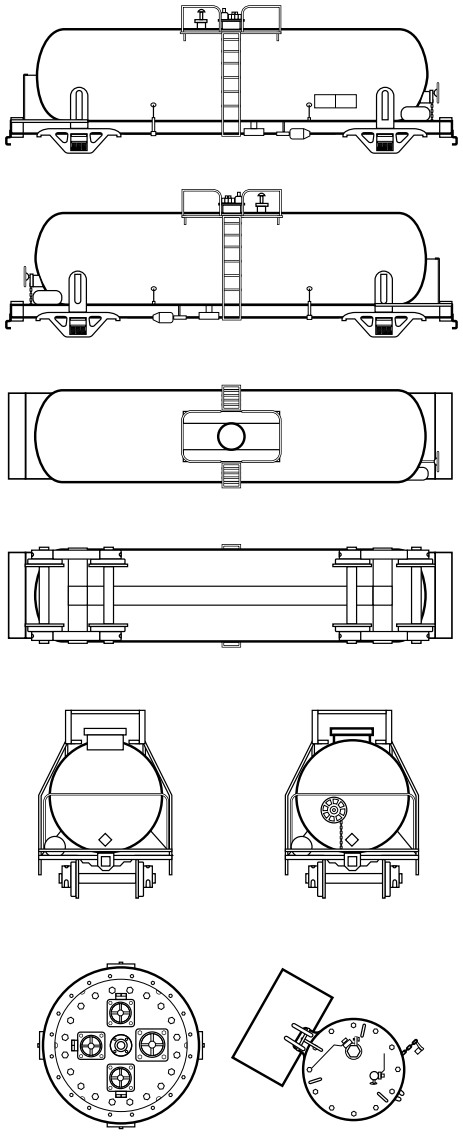
Thickness: _____

Fitting/Damage

Fitting	Damaged	Leaking	Picture Taken	Comments
Liquid Valve	☐	☐	☐	
Vapour Valve	☐	☐	☐	
BOV	☐	☐	☐	
PRD (1)	☐	☐	☐	PressureRating
PRD (2)	☐	☐	☐	PressureRating
VRV	☐	☐	☐	
Gauge	☐	☐	☐	
Manway	☐	☐	☐	
Fill Hole	☐	☐	☐	
Sample Line	☐	☐	☐	
Thermo Well	☐	☐	☐	

Car Diagram

Indicate location and severity of damage (punctures, cracks, scores, gouges, wheel burns, dents, rail burns, underframe and leaks) on the appropriate diagrams(s).



Picture Taken
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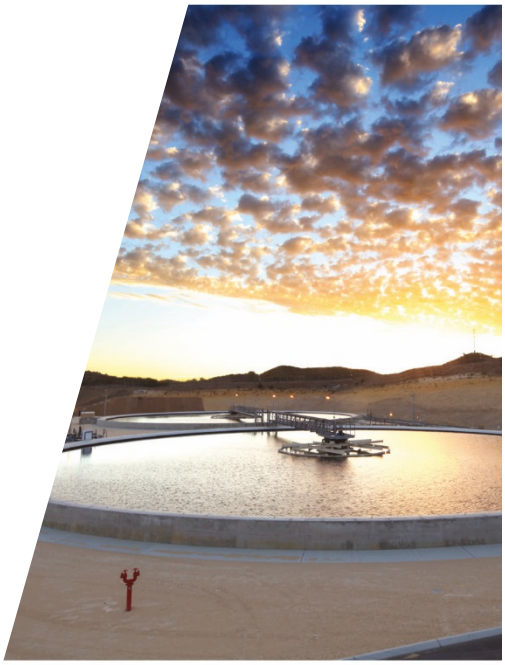
Inject 6
UAV Arial Imagery

Inject 7
Air Monitoring Plan



Air Monitoring Plan

Canadian Pacific Railway
Release Exercise

Canadian Pacific Railway

Table of Contents

Table Index

1. Introduction and Objectives

GHD was notified of a CP freight train derailment near Cambridge, Ontario at approximately 09:00 EST in September, 2019 (Site). This air monitoring plan was prepared to address the response to and subsequent cleanup of the derailment. According to the UN number and chemical information provided by CP Railway representatives, as well as recent experience with the commodity, the most prevalent Volatile Organic Compounds (VOCs) are denatured ethanol, styrene, and phenol. In addition, benzene may be present in denatured ethanol. These four compounds will be the constituents of interest (COI) based on the provided Safety Data Sheets (SDS).

To help ensure that CP, GHD, and contract employees working at the Site perimeter are adequately protected from exposure to potential air contaminants, GHD has developed this air monitoring plan (AMP).

The elements of the AMP include:

- Conducting perimeter air monitoring for lower explosive limit (LEL), phenol, ethanol, and styrene (as VOCs), and benzene at the derailment Site.
- Establish and implement procedures to ensure appropriate responses to elevated levels of COI. This may include identifying areas requiring respiratory protection, or arranging for a timely evacuation of the work Site in the event that hazardous concentrations of the COI are detected.
- Communicate the hazards associated with exposures to COI to the affected workers, members of the neighboring community, and other potential receptors.
- Provide recommendations for controlling Site exposures, respiratory protection and other personal protective equipment (PPE) to on-Site personnel.

GHD will continue air monitoring services until the clean-up phase of the project is completed and worker/community exposures to gases/vapors associated with the release are eliminated or until directed by CP that this service may be demobilized. The air monitoring data will be collected and compiled in accordance with established industrial hygiene guidelines and practices. In addition, the results will be communicated to CP, Site workers, and others as required and/or as necessary to ensure the safety and health of potentially affected individuals.

2. Exposure Standards and Guidelines

GHD will rely on the applicable Ontario regulatory standards and guidelines for workers. The province of Ontario relies on guidelines established by the American Conference of Governmental Industrial Hygienists (ACGIH) called Threshold Limit Values (TLV). TLVs are established to protect workers from air contaminants. The TLV for a substance is the concentration in air to which it is believed a worker can be exposed day after day for a working lifetime without adverse health effects. The TLVs will be used for this project to define overexposures. The US National Institute for Occupational Safety and Health (NIOSH) is a research agency which establishes another guideline called the Immediately Dangerous to Life and Health (IDLH). Table 1 lists the airborne compounds that will be measured and their 2017 ACGIH TLVs and NIOSH IDLHs.

Table 1 Occupational Exposure Limits and Guidelines

COI	2017 ACGIH TLV – TWA[1]	2017 ACGIH STEL[2]	NIOSH-IDLH [3]	Units
Benzene	0.5	2.5	500	Parts per million (ppm)
Ethanol	---	1000	3,300	
Styrene	20	40	700	
Phenol	50	---	250	

Notes:

1. Time Weighted Average (TWA) = The TWA concentration for a conventional 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect (ACGIH, 2017).
2. Short term exposure limit (STEL) - Usually a 15 minute TWA exposure that should not be exceeded at any time during a work day, even if the 8-hour TWA is with the TLV-TWA
3. Immediately Dangerous to Life and Health (IDLH) = Indicates an exposure to airborne contaminants that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment.

Action levels have been established to facilitate a timely and appropriate response to the detection of airborne hazards associated with released chemicals. Action levels have been set at levels lower than the established exposure limits and guidelines. The purpose is to ensure that if these levels are detected, they are effectively communicated to affected workers and off-Site receptors so that appropriate action can be taken. The Site-specific action levels for the work Site are listed in Table 2. Real-time monitoring will be conducted for VOCs and LEL.

2.1 Lower Explosive Limit

In addition to the exposure limits, most chemicals have a LEL concentration and an upper explosive limit (UEL) concentration. The range of concentrations between the LEL and UEL for a chemical is the explosive range. If the concentration of a chemical is in the explosive range, an adequate supply of oxygen is present, and an ignition source is introduced, an explosion or fire will occur. Therefore, with operations involving flammable gases or vapors it is critical that the concentrations not exceed the LEL to prevent a flash fire or explosion.

In gas/vapor detection systems, the amount of a particular gas/vapor present in an atmosphere is measured as a percentage (%) of the LEL or %LEL. For comparison, an instrument reading of 0% LEL indicates an atmosphere free of a combustible gas/vapor; while a measurement of 100% LEL denotes an atmosphere that is at the LEL for that gas/vapor. The relationship between %LEL and percentage of the gas/vapor by volume differs among combustible gases/vapors. NIOSH has established a safety factor to prevent workers from entering an explosive atmosphere. NIOSH considers an environment to be hazardous if a combustible gas/vapor is detected at 10% of its established LEL. As a result, these parameters will be used to determine the risk for a flammable/explosive atmosphere at the Site.

3. Real-Time Air Monitoring

Real-time air monitoring for COI may be performed during normal work operations using MultiRAE LITE 5 gas monitors, AreaRAEs, and UltraRAE 3000 monitors with benzene-specific detection tubes.

Instruments will be calibrated and operated in general accordance with the manufacturer's specifications or applicable test/method specifications. Real time air monitoring will be performed at the following locations:

- Impacted areas where workers are present.
- Site perimeter – upwind and downwind.
- Off-Site receptors (as identified and appropriate).

Air monitors will be placed at the perimeter of the work Site to continuously monitor VOC concentrations. Using radio telemetry, the instantaneous readings for each air monitor will be transmitted to a single host computer at the Site, allowing GHD personnel to simultaneously monitor the airborne concentrations for all perimeter stations from a central location. The UltraRAE will be used to screen for benzene within the work areas and at designated off-Site locations.

If airborne concentrations of the COI listed in Table 2 are detected above the action levels established for the Site, designated Site safety personnel, operations officials, affected workers, and/or local regulatory representatives will be notified and appropriate actions will be taken to ensure the health and safety of the Site workers.

Table 2 Real Time Air Monitoring Site Action Levels

Analyte	Action Level [1]	Description of Action
Lower Explosive Limit (LEL) [2]	< 5%	No action required.
	> 5%	LEL levels will be communicated to designated Site officials and all personnel will be instructed to be removed from the impacted areas. Indicates a potentially flammable atmosphere. No personnel shall be permitted in the impacted areas.
Ethanol (correction factor of 10 and ethanol TLV-STEL of 1000 ppm)	< 1000 ppm	No action required. **Determine benzene concentrations using chemical-specific detection method.**
	>1000- 1575 ppm (1/2 IDLH for ethanol)	Confirm with a duplicate sample. Communicate VOC concentrations to designated Site officials and initiate stop work authority (SWA). Notify workers of VOC levels and instruct them to don or continue wearing full-face, air purifying respirators (APR) equipped with organic vapor cartridges, if work is to continue. **Determine concentrations using chemical-specific detection method.** **If benzene levels are < 25 ppm, work can continue with workers wearing full-face, APRs equipped with organic vapor cartridges.** **Perform VOC air monitoring continuously until VOC concentrations are below 5.5 ppm.**

Table 2 Real Time Air Monitoring Site Action Levels

Analyte	Action Level [1]	Description of Action
		As long as VOC concentrations remain in this range, periodically, collect a benzene specific air monitoring reading to confirm benzene levels are < 0.5 ppm. **If benzene levels are ≥ 25 ppm, supplied air should be utilized**
	>1575 ppm	Communicate VOC (ethanol) concentrations to designated Site officials and initiate SWA. Consult with Project Certified Industrial Hygienist, Project Toxicologist, or other sufficiently qualified individuals to recommend a course of action that maintains operational effectiveness and reduces worker exposures to acceptable levels.
Benzene (**0.55 Correction Factor Applied** [3])	<0.5 ppm	No action required. **Determine benzene concentrations using chemical-specific detection method.**
	≥0.5-25 ppm	Confirm with a duplicate sample. Communicate benzene concentrations to designated Site officials and initiate SWA. Notify workers of benzene levels and instruct them to don or continue wearing full-face, APR equipped with organic vapor cartridges, if work is to continue. **Determine benzene concentrations using chemical-specific detection method [4].**
	>25 ppm	This concentration exceeds the maximum use concentration of a full face APR respirator. A supplied air respirator should be used at concentrations this action level. **Determine benzene concentrations using chemical-specific detection method.**
Phenol (1.0 correction factor applied)	<5 ppm	No action required. **Determine benzene concentrations using chemical-specific detection method.**
	>5 – 125 ppm	Confirm with a duplicate sample. Communicate VOC concentrations to designated Site officials and initiate stop work authority (SWA). Notify workers of VOC levels and instruct them to don or continue wearing full-face, air purifying respirators (APR) equipped with organic vapor cartridges, if work is to continue. Additionally, appropriate skin protective clothing should be worn by workers if skin contact with the chemical is considered a possibility. **Determine concentrations using chemical-specific detection method.**
	>125 ppm	Communicate VOC (phenol) concentrations to designated Site officials and initiate SWA. Consult with Project Certified Industrial Hygienist, Project Toxicologist, or other sufficiently qualified individuals to recommend a course of action that maintains operational effectiveness and reduces worker exposures to acceptable levels.

Table 2 Real Time Air Monitoring Site Action Levels

Analyte	Action Level [1]	Description of Action
Styrene (0.4 Correction factor applied)	<20 ppm	No action required
	>20 – 350 ppm	Confirm with a duplicate sample. Communicate VOC concentrations to designated Site officials and initiate stop work authority (SWA). Notify workers of VOC levels and instruct them to don or continue wearing full-face, air purifying respirators (APR) equipped with organic vapor cartridges, if work is to continue. Additionally, appropriate skin protective clothing should be worn by workers if skin contact with the chemical is considered a possibility. **Determine concentrations using chemical-specific detection method.**
	>350 ppm	Communicate VOC (styrene) concentrations to designated Site officials and initiate SWA. Consult with Project Certified Industrial Hygienist, Project Toxicologist, or other sufficiently qualified individuals to recommend a course of action that maintains operational effectiveness and reduces worker exposures to acceptable levels.
Oxygen	19.5-23.5 %	No action required.
	< 19.5 % or > 23.5 %	Communicate levels to designated Site representatives and initiate SWA.

Note:

[1] Action Levels are based on sustained (>1 min) airborne concentrations and are not corrected to account for the assigned protection factor of respirators used by Site personnel.

[2] LEL action levels are derived based upon expected correction factors for the LEL sensor for the mixture being greater than 2.0; however, at cold temperatures, work will likely be difficult

[3] Correction factors:

Benzene = VOC for isobutylene with a 10.6 lamp correction factor is 0.55
Phenol = VOC for isobutylene with a 10.6 lamp correction factor is 1.0
Styrene = VOC for isobutylene with a 10.6 lamp correction factor is 0.4
Ethanol = VOC for isobutylene with a 10.6 lamp correction factor is 10

% LEL – Percentage of the air concentration of a flammable gas in air which is sufficient to ignite and sustain combustion

ppm – parts per million

IDLH - concentration of COI is immediately dangerous to life and health

3.1 Community Exposure Guidelines

This plan will reference Ontario's Ambient Air Quality Criteria (AAQC), which are developed by the Ontario Ministry of the Environment Conservation and Parks (MECP). The AAQC are developed for all or part of the province to protect Ontario's air quality. Ontario has developed or adopted AAQC from other jurisdictions where there are no national objectives or Canada Wide Standards. AAQC are generally established for 10-minute, 24-hour, and annual averaging periods. Table 3.1 summarizes the Ontario AAQC for COI.

Table 3 Ontario Ambient Air Quality Criteria

COI	MECP AAQC	Averaging Time	Limiting Effect	Units
Benzene	2.3	24 Hour	Health	µg/m^3
Ethanol	19,000	1 Hour	Health	µg/m^3
Phenol	30	24 Hour	Health	µg/m^3
Styrene	400	24 Hour	Health	µg/m^3

Notes:
NE = Not Established
µg/m^3 = micrograms per cubic metre

Monitoring of properties potentially impacted will be conducted using real-time air monitoring techniques described below, on an as-needed basis, as determined by Site personnel. Many of the exposure standards and guidelines for COI shown in Table 3 are not of sufficient concentration to be measured instantaneously by a real-time air monitoring methods. Additionally, many of the standards or guidelines are intended to protect the general public and sensitive community members from lifetime exposures to each COI. Emergency exposures are generally much shorter and therefore different community standards are warranted for action levels at community locations.

The above action levels should provide adequate control to prevent off-Site migration of COIs. However, if work area air monitoring data indicates that the surrounding community may be impacted, then appropriate community action levels and responses will be developed and the air monitoring plan will be revised.

4. Integrated Air Sampling

GHD personnel may also perform integrated air sampling for COI at various locations around the site perimeter or on site workers to assess potential exposures. Integrated air samples allow for lower detection limits (when compared to real-time methods) and the results can be compared to the occupational exposure limits and the ambient air quality guidelines. This sampling will be performed on an as needed basis. Samples will be sent to an American Industrial Hygiene Accredited laboratory (SGS Galson Laboratories) for analysis. Note that the laboratory or project CIH should be contacted to determine the appropriate sampling time necessary to achieve the limit of detection for the COI in question.

Table 4 Integrated Air Sampling Method

Analyte	Sample Media	Flow Rate
Benzene	3M 3520	NA
Ethanol	3M 3520	NA
Phenol	XAD-7 Tube	0.1 LPM
Styrene	3M 3520	NA

Notes:
LPM – Litres per Minute
3M 3520 - 3M Passive Sampling Badge for VOCs
XAD-7 Tube - Sorbent tube for use with a sampling pump

5. Quality Assurance/Quality Control (QA/QC) and Reporting

Real-time data collected will be stored in an on-Site electronic archive. Manually-collected real-time data and integrated sampling information will be reviewed to ensure accuracy and completeness. The manually-collected monitoring/sampling data will be entered into an electronic database (spreadsheet or equivalent), and will undergo a quality assurance and quality control (QA/QC) review. Data entry forms and field notes will be kept on-Site and retained for reference upon completion of the project. If necessary, full laboratory analysis data packages will be provided, and associated data validation processes will be arranged.

During the project, interim reporting of results may be required. This may include data summaries, maps, or other presentations of preliminary monitoring and sampling results. For example, a data summary will be provided to CP every 24 hours, once data have undergone an initial QA/QC. Such reporting will be considered preliminary, as a final QA/QC of the data will not be complete. At the completion of the project, a report will be prepared in which data collected through real-time monitoring and integrated sampling analyses will be compiled, summarized, and reported to CN. Data contained in the final report will have been through the QA/QC process, will be reviewed by a Certified Industrial Hygienist (CIH), and will be considered final.

This plan was prepared by GHD based on information available and provided to GHD on September 17, 2019. As additional information becomes available, the plan may be revised as necessary and appropriate to meet the objectives as previously stated.

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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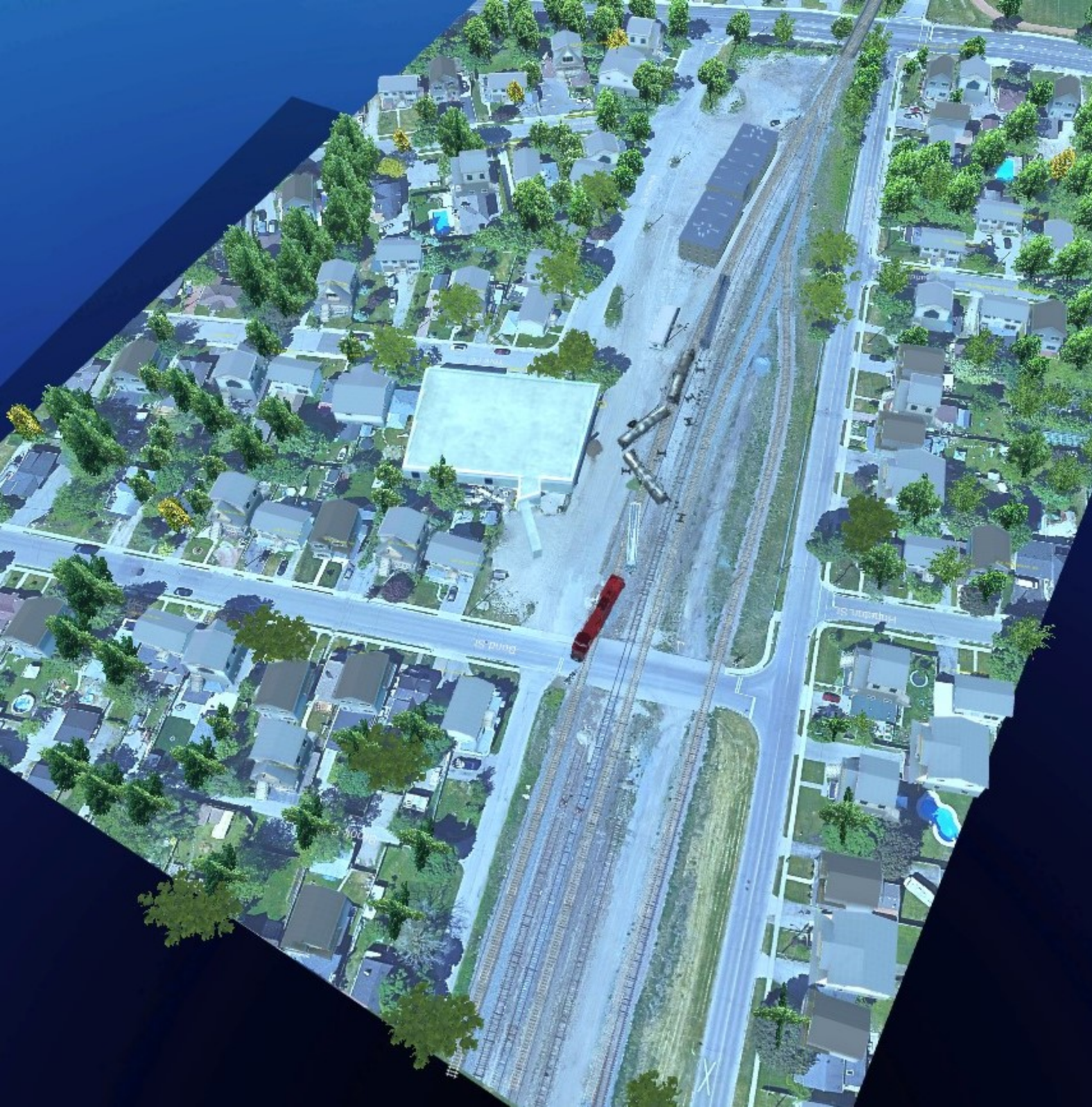
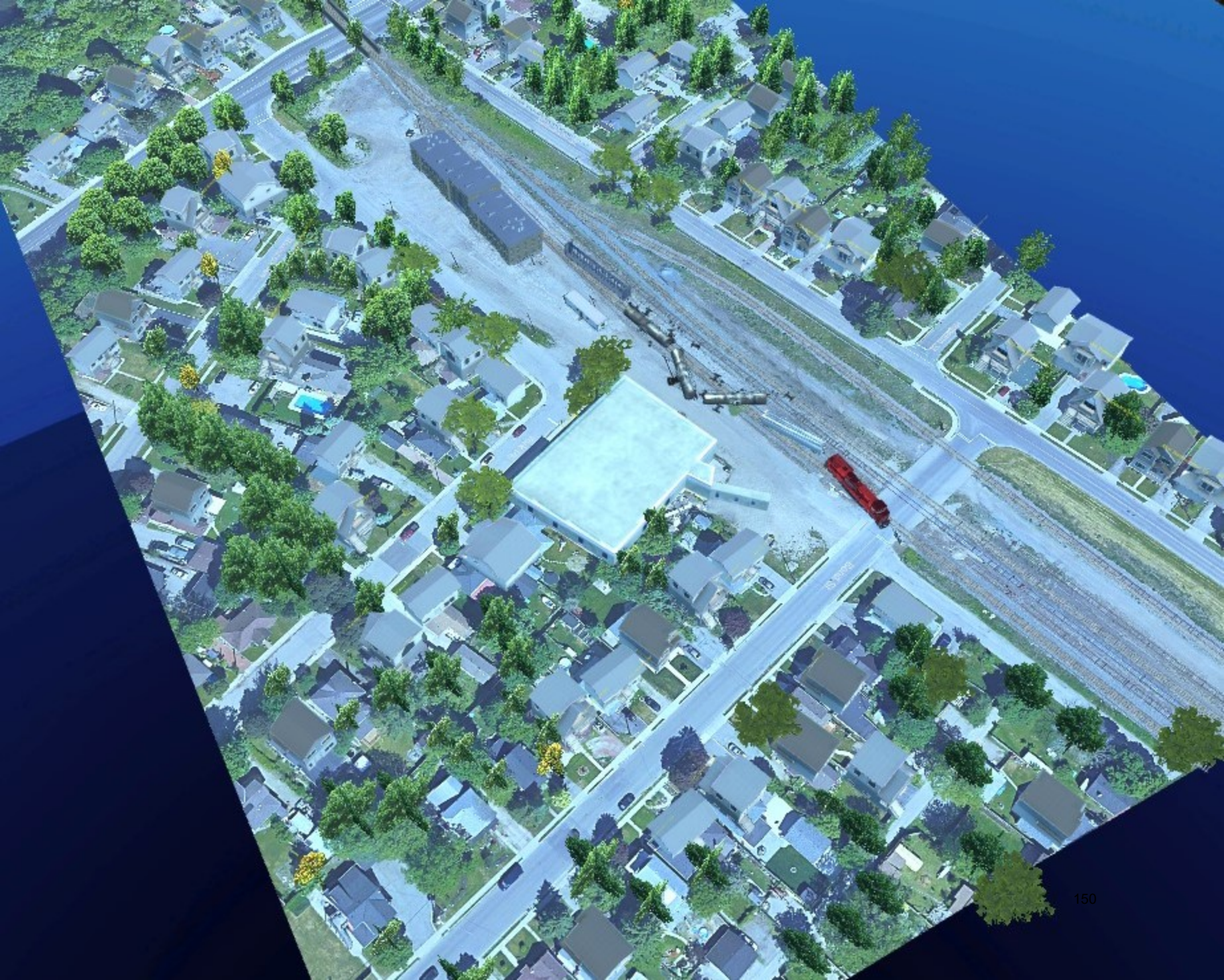
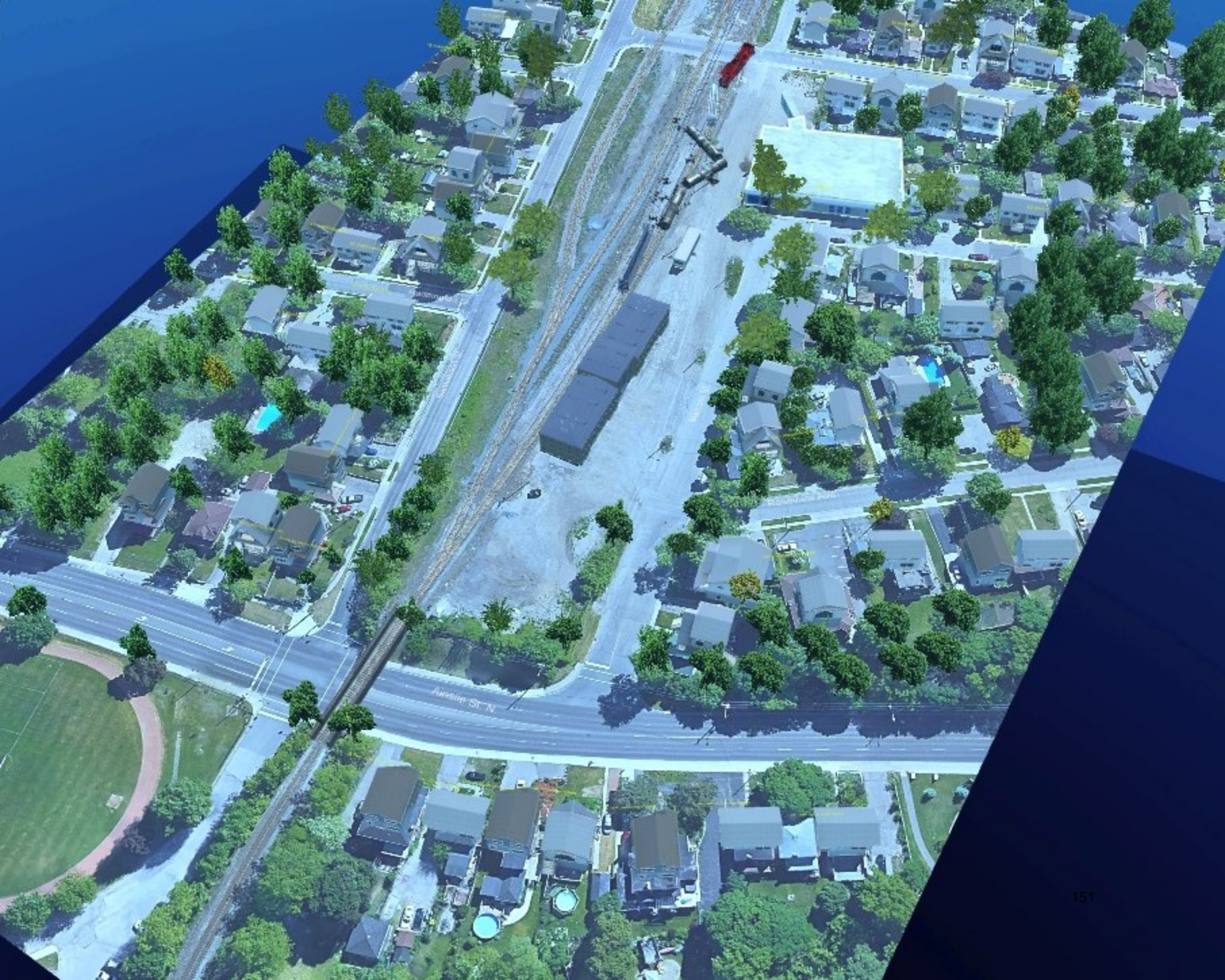
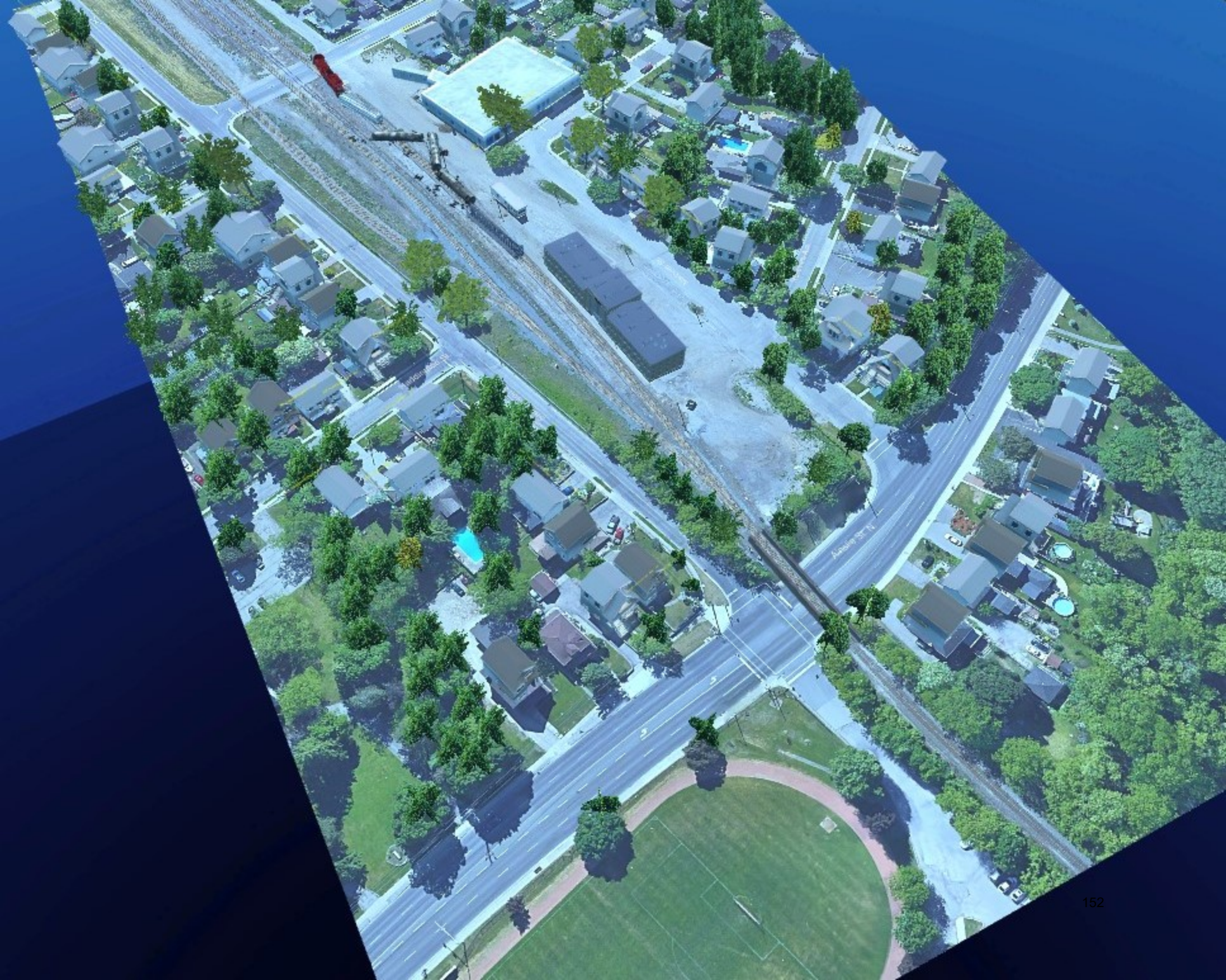
Inject 8
Imagery from Site









Inject 9
Air Monitoring Memo

Memorandum

To:	Canadian Pacific, DGO	Ref. No.:	11205945
From:	GHD/aj/1	Tel:	519-884-0510

Subject: Summary of Air Monitoring/Sampling Results for OP1

The purpose of this memorandum is to provide Canadian Pacific Railway (CP) Site management a summary of the air monitoring activities, results, and observations from the air monitoring being performed at the release Site. This summary memorandum summarizes the AreaRAE air monitoring data collected from operation period 1 (OP1) and the manually logged data from the same period recorded from within the Site work area. Real-time air monitoring was used as a screening tool to quickly indicate the presence of airborne concentrations of Compounds of Interest (COI) for the purpose of evaluating conditions at the perimeter of the Site. All air monitoring activities were conducted in accordance with the Air Monitoring Plan.

Manually Logged Real-time Data

The purpose of the manually logged data was to characterize (in real time) potential vapors and gases related to the release. Data was collected using handheld monitoring instruments equipped with a PID (10.6 eV lamp) for monitoring volatile organic compounds (VOCs) and chemical specific electrochemical sensors specific for carbon monoxide (CO), hydrogen sulfide (H_2S), and flammability (LEL). The data collected using these instruments was logged into an electronic handheld data collection device and stored in a secure GHD database. Manually logged VOC data is summarized in Attachment 1.

AreaRAE Real-time Data

GHD personnel deployed five (5) AreaRAE 5 gas monitors in order to continuously monitor work area and perimeter locations. During this operational period GHD has collected approximately 2,520 AreaRAE real-time readings in the work zone and perimeter areas using the real-time air monitoring instruments. No perimeter action level exceedances were noted during the reporting period. AreaRAE data is summarized in Attachment 2.

Next Operational Period

Site activities during the next operational period will include heavy equipment operations, remedial excavation, product recovery, environmental monitoring, and Site management activities. Air monitoring will continue to be conducted in accordance with the approved Air Monitoring Plan.

Attachment 1

Manually Logged Real-Time Data Summary							
Monitoring Period– OP1							
WORK AREA MONITORING							
Parameter	Number of Readings Collected	Number of Detectable Readings	Detectable Reading Minimum	Detectable Reading Average	Detectable Reading Maximum	Units	Comments
VOC	34	10	0.1	1.02	90*	ppm	*The maximum detected readings were collected within the active work area at the source zone, workers donning respiratory protection
Notes: VOC = Volatile Organic Compounds ppm = Parts Per Million							

Unit ID: 292-504501						
Location Description: AreaRAE North ~200m from Site						
Monitoring Period: OP1						
Parameter	Monitoring Period Summary		Detected Measurements Summary			
	Total # of Readings	TWA Concentration	Total # of Detections	Average Concentration of Detections	Total # of Readings Above Action Level	Maximum Airborne Concentration
VOCs	510	0.0 ppm	0	0.0 ppm	0	0.0 ppm
CO	510	0.0 ppm	0	0.0 ppm	0	0.0 ppm
H2S	510	0.0 ppm	0	0.0 ppm	0	0.0 ppm
LEL	510	0%	0	0%	0	0%

Unit ID: 292-504503						
Location Description: AreaRAE South ~200m from Site						
Monitoring Period: OP1						
Parameter	Monitoring Period Summary		Detected Measurements Summary			
	Total # of Readings	TWA Concentration	Total # of Detections	Average Concentration of Detections	Total # of Readings Above Action Level	Maximum Airborne Concentration
VOCs	526	0.00 ppm	0	0.0 ppm	0	0.0 ppm
CO	526	0.00 ppm	0	0.0 ppm	0	0.0 ppm
H2S	526	0.00 ppm	0	0.0 ppm	0	0.0 ppm
LEL	526	0 %	0	0%	0	0%

Unit ID: 292-504504						
Location Description: AreaRAE West ~ 200m from Site						
Monitoring Period: OP1						
Parameter	Monitoring Period Summary		Detected Measurements Summary			
	Total # of Readings	TWA Concentration	Total # of Detections	Average Concentration of Detections	Total # of Readings Above Action Level	Maximum Airborne Concentration
VOCs	498	0.0 ppm	0	0.0 ppm	0	0.0 ppm
CO	498	0.0 ppm	0	0.0 ppm	0	0.0 ppm
H2S	498	0.0 ppm	0	0.0 ppm	0	0.0 ppm
LEL	498	0%	0	0%	0	0%

Unit ID: W01A00000457						
Location Description: AreaRAE East ~ 200m from Site						
Monitoring Period: OP1						
Parameter	Monitoring Period Summary		Detected Measurements Summary			
	Total # of Readings	TWA Concentration	Total # of Detections	Average Concentration of Detections	Total # of Readings Above Action Level	Maximum Airborne Concentration
VOCs	519	0.3 ppm	94	0.3 ppm	0	1.9 ppm
CO	519	0.00 ppm	0	0.0 ppm	0	0.0 ppm
H2S	519	0.00 ppm	0	0.0 ppm	0	0.0 ppm
LEL	519	0%	0	0%	0	0%

Unit ID: 292-504502						
Location Description: AreaRAE at the work Site						
Monitoring Period: OP1						
Parameter	Monitoring Period Summary		Detected Measurements Summary			
	Total # of Readings	TWA Concentration	Total # of Detections	Average Concentration of Detections	Total # of Readings Above Action Level	Maximum Airborne Concentration
VOCs	467	1.7 ppm	411	1.7 ppm	8	29.9 ppm
CO	467	0.0 ppm	0	0.0 ppm	0	0 ppm
H2S	467	0.0 ppm	0	0.0 ppm	0	0.0 ppm
LEL	467	0%	0	0%	0	0%