RUBRIQUE 1: IDENTIFICATION DE LA SUBSTANCE/DU MÉLANGE ET DE LA SOCIÉTÉ/L'ENTREPRISE

1.1 Identificateur de produit: 901992 - TCPP

Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane

CAS: 1244733-77-4

EC: 807-935-0

Index: Non concerné

REACH: 01-2119486772-26-XXXX

Autres moyens d'identification:

Pas pertinent

1.2 Utilisations identifiées pertinentes de la substance ou du mélange et utilisations déconseillées:

Utilisations identifiées pertinentes: Formulation ou reconditionnement - Formulation en mélange / Utilisation sur les sites industriels - Production de mousse rigide / Utilisation généralisée par les professionnels - Mousse rigide (spray), application professionnelle / Utilisation sur les sites industriels - Production de mousse flexible / Utilisation sur les sites industriels - Granulés de mousse et mousse PUR rebond / Utilisation généralisée par les professionnels - Mousses PUR mono-composant, application professionnelle (moussage) / Utilisation grand public - Mousses PUR mono-composant, application grand public (moussage) / Utilisation sur les sites industriels - CASE, application industrielle / Utilisation généralisée par les professionnels - CASE, application professionnelle / Utilisation généralisée par les professionnels - Utilisation en laboratoire, professionnel / Durée de vie (consommateurs) - Mousse rigide, durée de vie / Durée de vie (consommateurs) - Mousse flexible, durée de vie

Utilisations déconseillées: Toute utilisation non spécifiée dans cette section ou dans la sous-rubrique 7.3

1.3 Renseignements concernant le fournisseur de la fiche de données de sécurité:

Quimidroga S.A.
C/ Tuset, 26
08006 Barcelona - Spain
Tél.: +34 932363636 - Fax: +34 934154880
msds@quimidroga.com
www.quimidroga.com

1.4 Numéro d'appel d'urgence: +34 932363636 (24h)

RUBRIQUE 2: IDENTIFICATION DES DANGERS **

2.1 Classification de la substance ou du mélange:

Règlement n° 1272/2008 (CLP) :

La classification de ce produit a été réalisée conformément au Règlement n° 1272/2008 (CLP).

Acute Tox. 4: Toxicité aiguë par ingestion, Catégorie 4, H302
Aquatic Chronic 3: Dangerosité chronique pour le milieu aquatique, Catégorie 3, H412
Carc. 2: Cancérogénicité, Catégorie 2, H351

2.2 Éléments d'étiquetage:

Règlement n° 1272/2008 (CLP) :

Attention

Indications de danger:

Acute Tox. 4: H302 - Nocif en cas d´ingestion.
Aquatic Chronic 3: H412 - Nocif pour les organismes aquatiques, entraîne des effets néfastes à long terme.
Carc. 2: H351 - Susceptible de provoquer le cancer.

Conseils de prudence:

*** Modifications par rapport à la version précédente*

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RUBRIQUE 2: IDENTIFICATION DES DANGERS ** (suite)

P264: Se laver les mains soigneusement après manipulation.
P270: Ne pas manger, boire ou fumer en manipulant ce produit.
P301+P312: EN CAS D'INGESTION: Appeler un CENTRE ANTIPOISON/un médecin en cas de malaise.
P330: Rincer la bouche.
P501: Éliminer le contenu/récipient conformément à la réglementation sur les déchets dangereux ou les emballages et déchets d´emballages.

2.3 Autres dangers:

Le produit ne répond pas aux critères des substances persistantes, bioaccumulables et toxiques (PBT) / des substances très persistantes et très bioaccumulables (vPvB)
Le produit ne répond pas aux critères relatifs aux propriétés de perturbation endocrinienne.

*** Modifications par rapport à la version précédente*

RUBRIQUE 3: COMPOSITION/INFORMATIONS SUR LES COMPOSANTS

3.1 Substances:

Conformément à l´Annexe II du Règlement (CE) nº1907/2006 (point 3), le produit contient:

Identification	Nom chimique /classification		Concentration
CAS: 1244733-77-4 EC: 807-935-0 Index: Non concerné REACH: 01-2119486772-26-XXXX	**Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane** Auto classifiée		**100 %**
	Règlement 1272/2008	Acute Tox. 4: H302; Aquatic Chronic 3: H412; Carc. 2: H351 - Attention 	

Pour plus d'informations sur les dangers du produit, voir les rubriques 11, 12 et 16.

L'estimation de la toxicité aiguë pour la substance figurant à l'annexe VI, partie 3, du règlement (CE) no 1272/2008 ou déterminée conformément à l'annexe I dudit règlement:

Identification	Toxicité sévère		Genre
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	DL50 orale	632 mg/kg	Rat
CAS: 1244733-77-4	DL50 cutanée	Pas pertinent	
EC: 807-935-0	CL50 inhalation	Pas pertinent	

3.2 Mélanges:

Non concerné

RUBRIQUE 4: PREMIERS SECOURS

4.1 Description des premiers secours:

Les symptômes résultant d´une intoxication peuvent survenir après l´exposition, raison pour laquelle, en cas de doute, toute exposition directe au produit chimique ou persistance de la gêne exige des soins médicaux, en fournissant la FDS du produit concerné.

Par inhalation:

Il s´agit d´un produit ne contenant pas de substances jugées dangereuses par inhalation, toutefois, en cas de symptômes d´intoxication, retirer la personne affectée de la zone d´exposition et lui fournir de l´air frais. Demander des soins médicaux si les symptômes s´aggravent ou persistent.

Par contact cutané:

En cas de contact, il est recommandé de rincer la zone affectée à l'eau claire et de nettoyer avec du savon neutre. En cas de manifestations cutanées (démangeaison, rougeur, éruptions cutanées, ampoules,…), consultez un médecin muni de la Fiche de Données de Sécurité.

Par contact avec les yeux:

Il s'agit d'un produit qui ne contient pas de substances classées dangereuses au contact avec les yeux. Rincer pendant au moins 15 minutes avec beaucoup d'eau à température ambiante, en évitant que la personne affectée se frotte ou ferme les yeux.

Par ingestion/aspiration:

Demander immédiatement des soins médicaux en fournissant la FDS du produit concerné. Ne pas provoquer de vomissement. En cas de vomissement, maintenir la tête penchée en avant pour éviter toute aspiration. En cas de perte de conscience, ne rien administrer par voie orale avant d´avoir obtenu l´avis d´un médecin. Rincer la bouche et la gorge, vu qu´il est possible qu´elles aient été touchées lors de l´ingestion. Maintenir la personne affectée au repos.

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RUBRIQUE 4: PREMIERS SECOURS (suite)

4.2 Principaux symptômes et effets, aigus et différés:

Les effets aigus et à retardement sont ceux signalés dans les rubriques 2 et 11.

4.3 Indication des éventuels soins médicaux immédiats et traitements particuliers nécessaires:

Pas pertinent

RUBRIQUE 5: MESURES DE LUTTE CONTRE L'INCENDIE

5.1 Moyens d'extinction:

Moyens d'extinction appropriés:

Produit non inflammable dans des conditions normales de stockage, de manipulation et d´utilisation. En cas d´inflammation provoquée par manipulation, stockage ou usage non conforme, utiliser de préférence des extincteurs à poudre polyvalente (poudre ABC), conformément au règlement sur les installations de protection incendie.

Moyens d'extinction inappropriés:

Pas pertinent

5.2 Dangers particuliers résultant de la substance ou du mélange:

La réaction suite à la combustion ou décomposition thermique peut s'avérer très toxique et par conséquent, représenter un risque très élevé pour la santé.

5.3 Conseils aux pompiers:

En fonction de l´ampleur de l´incendie, il pourra être nécessaire de porter des vêtements de protection intégrale ainsi qu´un équipement respiratoire personnel. Disposer d´un minimum d´installations d´urgence ou d´éléments d´intervention (couvertures ignifuges, trousse à pharmacie...) selon la Directive 89/654/CE.

Dispositions supplémentaires:

Intervenir conformément au Plan d´Urgences Intérieur et aux Fiches d´information relatives aux interventions en cas d´accidents et autres urgences. Supprimer toute source d´ignition. En cas d´incendie, refroidir les containers de stockage des produits susceptibles de s´enflammer ou d´exploser en raison des températures élevées. Éviter le déversement des produits servant à éteindre l´incendie en milieu aquatique.

RUBRIQUE 6: MESURES À PRENDRE EN CAS DE DISPERSION ACCIDENTELLE

6.1 Précautions individuelles, équipement de protection et procédures d'urgence:

Pour les non-secouristes:

Isoler les fuites à condition qu´il n´y ait pas de risque supplémentaire pour les personnes en charge de cette tâche. En cas de contact potentiel avec le produit déversé, il est obligatoire de porter l'équipement de protection individuelle (Voir rubrique 8). Évacuer la zone et maintenir éloignées les personnes sans protection.

Pour les secouristes:

Porter un équipement de sécurité. Eloigner les personnes non protégées. Voir rubrique 8.

6.2 Précautions pour la protection de l'environnement:

Éviter impérativement tout type de déversement en milieu aquatique. Conserver le produit absorbé dans des récipients hermétiques. Notifier à l´autorité compétente en cas d´exposition auprès du public ou de l´environnement.

6.3 Méthodes et matériel de confinement et de nettoyage:

Nous préconisons:

Absorber le déversement au moyen de sable ou d´un absorbant inerte et le mettre en lieu sûr. Ne pas absorber au moyen de sciure ou autres absorbants combustibles. Pour toute autre information relative à l´élimination, consulter la rubrique 13.

6.4 Référence à d´autres rubriques:

Voir les rubriques 8 et 13.

RUBRIQUE 7: MANIPULATION ET STOCKAGE

7.1 Précautions à prendre pour une manipulation sans danger:

A.- Précautions pour une manipulation en toute sécurité

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RUBRIQUE 7: MANIPULATION ET STOCKAGE (suite)

Respecter la législation en vigueur en matière de prévention des risques au travail concernant la manipulation des chargements à la main. Ordonner et ranger et procéder à l´élimination moyennant des méthodes sûres (chapitre 6).

B.- Recommandations techniques pour la prévention des incendies et des explosions.

Produit non inflammable dans des conditions normales de stockage, de manipulation et d´utilisation. Il est recommandé de procéder au transvasement lentement pour éviter de causer des décharges électrostatiques pouvant affecter les produits inflammables. Consulter la rubrique 10 concernant les conditions et les matières à éviter.

C.- Recommandations techniques pour la prévention des risques ergonomiques et toxicologiques.

Pour le contrôle de l'exposition, consulter la rubrique 8. Ne pas manger, boire et fumer dans les zones de travail; se laver les mains après chaque utilisation; enlever les vêtements et l'équipement de protection contaminés avant d'entrer dans une zone de restauration

D.- Recommandations techniques pour la prévention des risques environnementaux

Du fait de la dangerosité de ce produit pour l´environnement, il est recommandé de le manipuler à l´intérieur d´une zone ayant des barrières de contrôle contre la pollution en cas de déversement et de disposer également d´un matériel absorbant à proximité

7.2 Conditions d'un stockage sûr, y compris d'éventuelles incompatibilités:

A.- Exigences spécifiques en matière de stockage

Stocker dans un endroit frais, sec et bien aéré

B.- Conditions générales de stockage

Éviter toutes sources de chaleur, radiation, électricité statique et tout contact avec des aliments. Pour obtenir des informations supplémentaires voir sous-rubrique 10.5

7.3 Utilisation(s) finale(s) particulière(s):

A l'exception des indications déjà spécifiées, il n'est pas nécessaire de suivre des recommandations spéciales concernant l'usage de ce produit.

RUBRIQUE 8: CONTRÔLES DE L'EXPOSITION/PROTECTION INDIVIDUELLE

8.1 Paramètres de contrôle:

Substances dont les valeurs limites d´exposition professionnelle doivent être contrôlées sur le lieu de travail:

Il n´existe pas de valeurs limites d´exposition pour les substances qui constituent le produit

DNEL (Travailleurs):

		Courte exposition		Longue exposition	
Identification		Systémique	Local	Systémique	Local
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	Oral	Pas pertinent	Pas pertinent	Pas pertinent	Pas pertinent
CAS: 1244733-77-4	Cutanée	Pas pertinent	Pas pertinent	2,91 mg/kg	Pas pertinent
EC: 807-935-0	Inhalation	22,6 mg/m³	Pas pertinent	8,2 mg/m³	Pas pertinent

DNEL (Population):

		Courte exposition		Longue exposition	
Identification		Systémique	Local	Systémique	Local
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	Oral	2 mg/kg	Pas pertinent	0,52 mg/kg	Pas pertinent
CAS: 1244733-77-4	Cutanée	Pas pertinent	Pas pertinent	1,04 mg/kg	Pas pertinent
EC: 807-935-0	Inhalation	1,04 mg/m³	Pas pertinent	1,45 mg/m³	Pas pertinent

PNEC:

Identification				
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	STP	19,1 mg/L	Eau douce	0,32 mg/L
CAS: 1244733-77-4	Sol	0,34 mg/kg	Eau de mer	0,032 mg/L
EC: 807-935-0	Intermittent	0,51 mg/L	Sédiments (Eau douce)	11,5 mg/kg
	Oral	0,0116 g/kg	Sédiments (Eau de mer)	1,15 mg/kg

8.2 Contrôles de l'exposition:

A.- Mesures de protection individuelle, telles que les équipements de protection individuelle

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RUBRIQUE 8: CONTRÔLES DE L'EXPOSITION/PROTECTION INDIVIDUELLE (suite)

À titre de mesure préventive, il est recommandé d'utiliser les équipements de protection individuelle basiques, avec le <marquage CE> correspondant. Pour plus de renseignements sur les équipements de protection individuelle (stockage, utilisation, nettoyage, entretien, type de protection,…) consulter la brochure d'informations fournie par le fabricant de l'EPI. Les indications formulées dans ce point concernent le produit pur. Les mesures de protection concernant le produit dilué pourront varier en fonction de son degré de dilution, de son utilisation, de la méthode d'application, etc. Pour déterminer l'obligation d'installer des douches de sécurité et/ou des rince-œil de secours dans les entrepôts, respecter la règlementation concernant le stockage de produits chimiques applicable dans chaque cas. Pour plus de renseignements, se référer aux sous-rubriques 7.1 et 7.2. Toute l´information contenue ici est une recommandation qui nécessite une spécification de la part des services de prévention des risques au travail, si la société dispose de mesures supplémentaires.

B.- Protection respiratoire.

Pictogramme	PPE	Marquage	normes ECN	Observations
 Protection des voies respiratoires obligatoire	Masque auto filtrant contre les gaz et les vapeurs	CE CAT III	EN 405:2002+A1:2010	À remplacer dès lors qu´une odeur ou un goût du produit contaminant à l´intérieur du masque ou de l´adaptateur facial est détecté. Quand le produit contaminant ne présente pas les avertissements corrects, il est recommandé d´utiliser des équipements isolants.

C.- Protection spécifique pour les mains.

Pictogramme	PPE	Marquage	normes ECN	Observations
 Protection des mains obligatoire	Gants de protection chimique, non jetable	CE CAT III	EN ISO 374-1:2016+A1:2018 EN 16523-1:2015+A1:2018 EN ISO 21420:2020	Le temps d´imprégnation (Breakthrough Time) indiqué par le fabricant doit être supérieur au temps d´utilisation du produit. Ne pas utiliser des crèmes protectrices après tout contact du produit avec la peau.

D.- Protection du visage et des yeux

Pictogramme	PPE	Marquage	normes ECN	Observations
 Protection du visage obligatoire	Écran facial	CE CAT II	EN 166:2002 EN 167:2002 EN 168:2002 EN ISO 4007:2018	Nettoyer quotidiennement et désinfecter régulièrement en suivant les instructions du fabricant. À utiliser s´il y a un risque d'éclaboussements.

E.- Protection du corps

Pictogramme	PPE	Marquage	normes ECN	Observations
 Protection du corps obligatoire	Vêtement de protection en cas de risques chimiques	CE CAT III	EN 13034:2005+A1:2009 EN 168:2002 EN ISO 13982-1:2004/A1:2010 EN ISO 6529:2013 EN ISO 6530:2005 EN 464:1994	Usage exclusif au travail.
 Protection des pieds obligatoire	Chaussures de sécurité contre risque chimique	CE CAT III	EN ISO 20345:2011 EN 13832-1:2019	Remplacer les bottes en présence de n´importe quel indice d´usure.

F.- Mesures complémentaires d'urgence

Mesure d'urgence	normes	Mesure d'urgence	normes
 Douche d'urgence	ANSI Z358-1 ISO 3864-1:2011, ISO 3864-4:2011	 Rincer œil	DIN 12 899 ISO 3864-1:2011, ISO 3864-4:2011

Contrôles d'exposition liés à la protection de l'environnement:

En vertu de la législation communautaire sur la protection environnementale, il est recommandé d´éviter tout déversement du produit mais aussi de son emballage dans l´environnement. Pour obtenir des informations supplémentaires voir sous-rubrique 7.1.D

Composés organiques volatiles:

Conformément à l´application de la Directive 2010/75/EU, ce produit offre les caractéristiques suivantes:

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RUBRIQUE 8: CONTRÔLES DE L'EXPOSITION/PROTECTION INDIVIDUELLE (suite)

C.O.V. (2010/75/UE):	0 % poids
Concentration de C.O.V. à 20 ºC:	0 kg/m³ (0 g/L)
Nombre moyen de carbone:	Pas pertinent
Poids moléculaire moyen:	Pas pertinent

RUBRIQUE 9: PROPRIÉTÉS PHYSIQUES ET CHIMIQUES

9.1 Informations sur les propriétés physiques et chimiques essentielles:

Pour plus d'informations voir la fiche technique du produit.

Aspect physique:

État physique à 20 ºC:	Liquide
Aspect:	Transparent
Couleur:	Non disponible
Odeur:	Doux
Seuil olfactif:	Pas pertinent *

Volatilité:

Température d'ébullition à pression atmosphérique:	288 ºC
Pression de vapeur à 20 ºC:	Pas pertinent *
Pression de vapeur à 50 ºC:	<300000 Pa (300 kPa)
Taux d'évaporation à 20 ºC:	Pas pertinent *

Caractéristiques du produit:

Masse volumique à 20 ºC:	Pas pertinent *
Densité relative à 20 ºC:	1,29
Viscosité dynamique à 20 ºC:	68,5 cP
Viscosité cinématique à 20 ºC:	Pas pertinent *
Viscosité cinématique à 40 ºC:	Pas pertinent *
Concentration:	Pas pertinent *
pH:	Pas pertinent *
Densité de vapeur à 20 ºC:	Pas pertinent *
Coefficient de partage n-octanol/eau à 20 ºC:	Pas pertinent *
Solubilité dans l'eau à 20 ºC:	1,1 kg/m³
Propriété de solubilité:	Pas pertinent *
Température de décomposition:	Pas pertinent *
Point de fusion/point de congélation:	<-20 ºC

Inflammabilité:

Point d'éclair:	>100 ºC
Inflammabilité (solide, gaz):	Pas pertinent *
Température d'auto-ignition:	>400 ºC
Limite d'inflammabilité inférieure:	Pas pertinent *
Limite d'inflammabilité supérieure:	Pas pertinent *

Caractéristiques des particules:

Diamètre équivalent médian:	Non concerné

9.2 Autres informations:

Informations concernant les classes de danger physique:

*Pas pertinent en raison de la nature du produit / non déterminant pour les propriétés de danger du produit

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RUBRIQUE 9: PROPRIÉTÉS PHYSIQUES ET CHIMIQUES (suite)

Propriétés explosives:	Pas pertinent *
Propriétés comburantes:	Pas pertinent *
Substances ou mélanges corrosifs pour les métaux:	Pas pertinent *
Chaleur de combustion:	Pas pertinent *
Aérosols-pourcentage total suivant (en masse) de composants inflammables:	Pas pertinent *

Autres caractéristiques de sécurité:

Tension superficielle à 20 ºC:	Pas pertinent *
Indice de réfraction:	Pas pertinent *

*Pas pertinent en raison de la nature du produit / non déterminant pour les propriétés de danger du produit

RUBRIQUE 10: STABILITÉ ET RÉACTIVITÉ

10.1 Réactivité:

Aucune réaction dangereuse attendue dans les conditions normales de stockage, manipulation et utilisation. Voir la rubrique 7 de la Fiche de Données de Sécurité.

10.2 Stabilité chimique:

Chimiquement stable dans les conditions indiquées de stockage, manipulation et utilisation.

10.3 Possibilité de réactions dangereuses:

En conditions normales, pas de réactions dangereuses susceptibles de produire une pression ou des températures excessives.

10.4 Conditions à éviter:

Applicables pour manipulation et stockage à température ambiante :

Choc et friction	Contact avec l'air	Échauffement	Lumière Solaire	Humidité
Non applicable	Non applicable	Non applicable	Non applicable	Non applicable

10.5 Matières incompatibles:

Acides	Eau	Matières comburantes	Matières combustibles	Autres
Eviter les acides forts	Non applicable	Non applicable	Non applicable	Éviter les alcalins ou les bases fortes

10.6 Produits de décomposition dangereux:

Voir sous-rubriques 10.3, 10.4 et 10.5 pour connaître précisément les produits de décomposition. En fonction des conditions de décomposition et à l´issue de cette dernière, certains mélanges complexes à base de substances chimiques peuvent se dégager: dioxyde de carbone (CO_2), monoxyde de carbone et autres composés organiques.

RUBRIQUE 11: INFORMATIONS TOXICOLOGIQUES

11.1 Informations sur les classes de danger telles que définies dans le règlement (CE) no 1272/2008:

Effets dangereux pour la santé:

En cas d'exposition répétée, prolongée ou de concentrations supérieures à celles qui sont établies par les limites d'exposition professionnelles, des effets néfastes pour la santé peuvent survenir selon le mode d'exposition :

A- Ingestion (effets aigus):

- Toxicité aiguë: L´ingestion d´une forte dose peut provoquer une irritation de la gorge, une douleur abdominale, des nausées et des vomissements.
- Corrosivité/irritabilité: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

B- Inhalation (effets aigus):

- Toxicité aiguë: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses par inhalation. Pour plus d´information, voir rubrique 3.
- Corrosivité/irritabilité: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

C- Contact avec la peau et les yeux (effets aigus):

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RUBRIQUE 11: INFORMATIONS TOXICOLOGIQUES (suite)

- Contact avec la peau: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, et ne contiennent pas de substances jugées dangereuses au vu des effets décrits. Pour plus d´information, voir rubrique 3.
- Contact avec les yeux: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

D- Effets CMR (carcinogénicité, mutagénicité et toxicité pour la reproduction):

- Carcinogénicité: L´exposition à ce produit peut entraîner un cancer. Pour plus d´information concernant les éventuels effets spécifiques sur la santé voir rubrique 2.
  IARC: Pas pertinent
- Mutagénicité: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.
- Toxicité sur la reproduction: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

E- Effets de sensibilisation:

- Respiratoire: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses à effets sensibilisants. Pour plus d´information, voir rubrique 3.
- Cutané: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

F- Toxicité pour certains organes cibles (STOT)-temps d'exposition:

Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

G- Toxicité pour certains organes cibles (STOT)-exposition répétée:

- Toxicité pour certains organes cibles (STOT)-exposition répétée: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.
- Peau: Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

H- Danger par aspiration:

Compte tenu des données disponibles, les critères de classification ne sont pas remplis, car le produit ne contient pas de substances jugées dangereuses dans ce cadre. Pour plus de renseignements, se référer à la rubrique 3.

Autres informations:

Pas pertinent

Information toxicologique spécifique produit:

Toxicité sévère		Genre
DL50 orale	632 mg/kg (ATEi)	Rat
DL50 cutanée	>2000 mg/kg	Rat
CL50 inhalation	>7 mg/L (4 h)	Rat

Information toxicologique spécifique des substances:

Identification	Toxicité sévère		Genre
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	DL50 orale	632 mg/kg (ATEi)	Rat
CAS: 1244733-77-4	DL50 cutanée	>2000 mg/kg	Rat
EC: 807-935-0	CL50 inhalation	>7 mg/L (4 h)	Rat

11.2 Informations sur les autres dangers:

Propriétés perturbant le système endocrinien

Le produit ne répond pas aux critères relatifs aux propriétés de perturbation endocrinienne.

Autres informations

Pas pertinent

RUBRIQUE 12: INFORMATION ÉCOLOGIQUE

Nocif pour les organismes aquatiques, entraîne des effets néfastes à long terme.

12.1 Toxicité:

- SUITE À LA PAGE SUIVANTE -

RUBRIQUE 12: INFORMATION ÉCOLOGIQUE (suite)

Toxicité aquatique spécifique produit:

Toxicité sévère		Espèce	Genre
CL50	51 mg/L (96 h)	N/A	Poisson
CE50	131 mg/L (48 h)	Non concerné	Crustacé
CE50	82 mg/L (72 h)	Non concerné	Algue

Toxicité aquatique spécifique des substances:

Toxicité sévère:

Identification	Concentration		Espèce	Genre
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	CL50	>10 - 100 mg/L (96 h)		Poisson
CAS: 1244733-77-4	CE50	>10 - 100 mg/L (48 h)		Crustacé
EC: 807-935-0	CE50	>10 - 100 mg/L (72 h)		Algue

Toxicité chronique:

Identification	Concentration		Espèce	Genre
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	NOEC	Pas pertinent		
CAS: 1244733-77-4 EC: 807-935-0	NOEC	32 mg/L	Daphnia magna	Crustacé

12.2 Persistance et dégradabilité:

Informations spécifiques à la substance:

Identification	Dégradabilité		Biodégradabilité	
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	DBO5	Pas pertinent	Concentration	20 mg/L
CAS: 1244733-77-4	DCO	Pas pertinent	Période	28 jours
EC: 807-935-0	DBO5/DCO	Pas pertinent	% Biodégradé	14 %

12.3 Potentiel de bioaccumulation:

Informations spécifiques à la substance:

Identification	Potentiel de bioaccumulation	
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	FBC	8
CAS: 1244733-77-4	Log POW	3,17
EC: 807-935-0	Potentiel	Bas

12.4 Mobilité dans le sol:

Identification	L´absorption/désorption		Volatilité	
Produits de réaction du trichlorure de phosphoryle et du 2-méthyloxirane	Koc	324,2	Henry	6E-3 Pa·m³/mol
CAS: 1244733-77-4	Conclusion	Modéré	Sol sec	Pas pertinent
EC: 807-935-0	Tension superficielle	Pas pertinent	Sol humide	Pas pertinent

12.5 Résultats des évaluations PBT et VPVB:

Le produit ne répond pas aux critères des substances persistantes, bioaccumulables et toxiques (PBT) / des substances très persistantes et très bioaccumulables (vPvB)

12.6 Propriétés perturbant le système endocrinien:

Le produit ne répond pas aux critères relatifs aux propriétés de perturbation endocrinienne.

12.7 Autres effets néfastes:

Non décrits

RUBRIQUE 13: CONSIDÉRATIONS RELATIVES À L'ÉLIMINATION

13.1 Méthodes de traitement des déchets:

Code	Description	Type de déchet (Règlement (UE) n °1357/2014)
	Il n´est pas possible d´attribuer un code spécifique, étant donné que cela dépend de l´usage prévu par le destinataire	Dangereux

- SUITE À LA PAGE SUIVANTE -

RUBRIQUE 13: CONSIDÉRATIONS RELATIVES À L'ÉLIMINATION (suite)

Type de déchets (Règlement (UE) n °1357/2014):

HP14 Écotoxique, HP6 Toxicité aiguë, HP7 Cancérogène

Gestion du déchet (élimination et évaluation):

Consulter le responsable des déchets compétent en matière d´évaluation et élimination conformément à l´Annexe 1 et l´Annexe 2 (Directive 2008/98/CE, Décret no 2011-828, Ordonnance no 2010-1579). Conformément aux codes 15 01 (2014/955/CE), au cas où l´emballage entrerait en contact avec le produit, il faudra procéder de la même façon qu´avec le propre produit, dans le cas contraire, il faudra le traiter comme un résidu non dangereux. Il est fortement déconseillé de le verser dans des cours d´eau. Voir sous-rubrique 6.2.

Dispositions se rapportant au traitement des déchets:

Conformément à l´Annexe II du Règlement (CE) nº1907/2006 (REACH) les dispositions communautaires ou nationales se rapportant au traitement des déchets sont appliquées.
Législation communautaire: Directive 2008/98/CE, 2014/955/CE, Règlement (UE) n °1357/2014

RUBRIQUE 14: INFORMATIONS RELATIVES AU TRANSPORT

Ce produit n´est pas réglementé pour le transport (ADR/RID, IMDG, IATA)

RUBRIQUE 15: INFORMATIONS RELATIVES À LA RÉGLEMENTATION

15.1 Réglementations/législations particulières à la substance ou au mélange en matière de sécurité, de santé et d'environnement:

- Article 95, RÈGLEMENT (UE) No 528/2012: Pas pertinent
- Règlement (UE) 2024/590 sur les substances qui perforent la couche d´ozone : Pas pertinent
- RÈGLEMENT (UE) No 649/2012 régissant l´exportation et l´importation de produits chimiques dangereux: Pas pertinent
- Substances inscrites à l´annexe XIV de REACH (liste d´autorisation) et date d´expiration: Pas pertinent
- Substances soumises à autorisation dans le Règlement (CE) 1907/2006 (REACH): Pas pertinent

Seveso III:

Pas pertinent

Restrictions en matière de commercialisation et d´usage de certaines substances et mélanges dangereux (Annexe XVII REACH, etc...):

Ne peuvent être utilisés:
—dans des articles décoratifs destinés à produire des effets de lumière ou de couleur obtenus par des phases différentes, par exemple dans des lampes d'ambiance et des cendriers,
—dans des farces et attrapes,
—dans des jeux destinés à un ou plusieurs participants ou dans tout article destiné à être utilisé comme tel, même sous des aspects décoratifs.

Dispositions spéciales en matière de protection des personnes ou d'environnement:

Il est recommandé d'utiliser l'information recueillie sur cette fiche de données de sécurité faisant office d'information de départ pour une évaluation des risques des circonstances locales dans le but d'établir les mesures nécessaires en matière de prévention des risques pour la manipulation, l'utilisation, le stockage et l'élimination du produit.

Autres législations:

Pas pertinent

15.2 Évaluation de la sécurité chimique:

Le fournisseur a effectué l´évaluation de la sécurité chimique.

RUBRIQUE 16: AUTRES INFORMATIONS **

Législation s'appliquant aux fiches de données en matière de sécurité:
Cette fiche de données en matière de sécurité a été réalisée conformément à l´ANNEXE II - Guide pour élaborer des Fiches de Données en matière de Sécurité du Règlement (CE) Nº 1907/2006 (RÈGLEMENT (UE) 2020/878 DE LA COMMISSION)

Modifications par rapport à la fiche de sécurité précédente avec répercussions sur les mesures de gestion du risque :

*** Modifications par rapport à la version précédente*

- SUITE À LA PAGE SUIVANTE -

RUBRIQUE 16: AUTRES INFORMATIONS ** (suite)

Règlement n° 1272/2008 (CLP) (RUBRIQUE 2, RUBRIQUE 16):
- Pictogrammes
- Indications de danger

Textes des phrases législatives dans la rubrique 2:

H302: Nocif en cas d´ingestion.
H351: Susceptible de provoquer le cancer.
H412: Nocif pour les organismes aquatiques, entraîne des effets néfastes à long terme.

Textes des phrases législatives dans la rubrique 3:

Les phrases inscrites ne portent pas sur le produit lui-même, elles sont seulement à titre d'information et se réfèrent aux composants individuels qui apparaissent dans la section 3

Règlement n° 1272/2008 (CLP) :

Acute Tox. 4: H302 - Nocif en cas d´ingestion.
Aquatic Chronic 3: H412 - Nocif pour les organismes aquatiques, entraîne des effets néfastes à long terme.
Carc. 2: H351 - Susceptible de provoquer le cancer.

Conseils relatifs à la formation:

Une formation minimum en matière de prévention des risques au travail est recommandée pour le personnel qui va manipuler ce produit, dans le but de faciliter la compréhension et l´interprétation de cette fiche de données de sécurité au même titre que l´étiquetage du produit.

Sources de documentation principale:

http://echa.europa.eu
http://eur-lex.europa.eu

Abréviations et acronymes:

ADR: Accord européen relatif au transport international des marchandises dangereuses par route
IMDG: Code maritime international des marchandises dangereuses
IATA: Association internationale du transport aérien
ICAO: Organisation de l´aviation civile internationale
DCO: Demande chimique en oxygène
DBO5: Demande biologique en oxygène après 5 jours
FBC: Facteur de bioconcentration
DL50: Dose létale 50 CL50: Concentration létale 50
CE50: Concentration effective 50
Log Pow: Coefficient de partage octanol/eau
UFI: identifiant unique de formulation
IARC: Centre international de recherche sur le cancer

*** Modifications par rapport à la version précédente*

- FIN DE LA FICHE DE DONNÉES DE SÉCURITÉ -

Annex to extended safety data sheet (eSDS)

9. EXPOSURE ASSESSMENT (and related risk characterisation)

The sections 9 and 10 of this CSR have been generated with Chesar 3.3.

9.0. Introduction

9.0.1. Overview on uses

See the description of the various uses in section 2 of the CSR.

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers intended to provide a Chemical Safety Assessment (CSA) that can be considered representative for the EU TCPP market.

In May 2008, the European Union (EU) finalised the Risk Assessment Report (RAR) on tris(2-chloro-1-methylethyl) phosphate (TCPP) in accordance with Council Regulation (EEC) 793/93 on the evaluation and control of the risks of "existing" substances (ECB, 2008). The TCPP EU RAR was developed by the Member States Ireland (lead) and United Kingdom in close cooperation with companies manufacturing, importing and/or using TCPP.

The below CSA for TCPP is based on the existing TCPP EU RAR, which means that where relevant the publically available information from the TCPP EU RAR served as a basis for the assessment of the contributing scenarios described below in this Chemical Safety Report (CSR). However, changes in the production volume and differences in the approach to develop the contributing scenarios made it necessary to implement some deviations from the TCPP EU RAR. These deviations are noted/discussed per contributing scenario.

Table 9.0. Overview on uses

Exposure Scenario	Manufacture	Formulation	End use			Service life	Environmental Release Category (ERC)	Process Category (PROC)	Sector of Use (SU)	Product Category (PC)	Article Category (AC)
			Industrial	Professional	Consumer						
9.1. Exposure scenario 1: Manufacture - Manufacture of TCPP	X						1	1, 2, 3, 8b, 9, 15	-	-	-
9.2. Exposure scenario 2: Formulation or re-packing - Formulation into mixture		X					2	1, 2, 3, 4, 5, 8a, 8b, 9, 15	-	-	-
9.3. Exposure scenario 3: Use at industrial sites - Rigid foam production			X				5	1, 2, 3, 4, 5, 7, 8a, 8b, 9, 15, 21	12, 19	32	-
9.4. Exposure scenario 4: Widespread use by professional workers - Rigid (spray) foam, professional application				X			8c, 8f	5, 8a, 8b, 10, 11, 21	19	32	-
9.5. Exposure scenario 5: Use at industrial sites - Flexible foam production			X				5	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 21	12, 18	32	-
9.6. Exposure scenario 6: Use at industrial sites - Foam granules and rebound PUR foam			X				5	1, 2, 3, 4, 5, 8a, 8b, 9, 14, 15, 21	18, 19	32	-
9.7. Exposure scenario 7: Widespread use by professional workers - One-component PUR foams, professional application (foaming)				X			8c, 8f	10, 11,21	19	1, 32	-
9.8. Exposure scenario 8: Consumer use - One-component PUR foams, consumer application (foaming)					X		8c, 8f	-	-	1, 32	-
9.9. Exposure scenario 9: Use at industrial sites - CASE, industrial application			X				5	1, 2, 3, 4, 6, 7, 8a, 8b, 9, 10, 13, 14, 15	12	1, 9a, 32	-

Exposure Scenario	Manufacture	Formulation	End use			Service life	Environmental Release Category (ERC)	Process Category (PROC)	Sector of Use (SU)	Product Category (PC)	Article Category (AC)
			Industrial	Professional	Consumer						
9.10. Exposure scenario 10: Widespread use by professional workers - CASE, professional application				X			8c, 8f	5, 8a, 8b, 10, 11,21	12	1, 9a, 32	-
9.11. Exposure scenario 11: Widespread use by professional workers - Laboratory use, professional				X			8c	15	-	-	-
9.12. Exposure scenario 12: Service life consumers) - Rigid foam, service life						X	10a, 11a	-	-	-	13
9.13. Exposure scenario 13: Service life consumers) - Flexible foam, service life						X	10a, 11a	-	-	-	1, 5

9.0.2. Assessment entity groups

Not applicable

9.0.3. Introduction to the assessment for the environment

9.0.3.1. Tonnage

Assessed tonnage: 4.8E4 tonnes/year based on:

4.8E4 tonnes/year manufactured

Tonnage supplied per market sector:

Foam granules and rebound PUR foam: 1.22E3 tonnes/year

Rigid foam production: 2.93E4 tonnes/year

Flexible foam production: 5.23E3 tonnes/year

Coatings, adhesives, sealants and elastomers ('CASE'): 258 tonnes/year

One-component PUR foams: 8.88E3 tonnes/year

The following table provides the tonnage per use and the local tonnages used in the assessment for each environmental contributing activity. The local tonnage corresponds to a tonnage at the site for uses taking place at industrial sites and to a tonnage assumed for a town of 10 000 inhabitants for widespread uses.

Table 9.1. Tonnage for assessment

ES#	Exposure scenario (ES) name and related environmental contributing scenarios	Tonnage per use (t/year)	Daily local tonnage (t/day)	Annual local tonnage (t/year)
ES1 (M)	Manufacture of TCPP	4.8E4		
	- Manufacture of TCPP (ERC 1)		145.5	4.8E4
ES2 (F)	Formulation into mixture	2.06E4		
	- Formulation into mixture (ERC 2)		13.71	4.11E3
ES3 (IS)	Rigid foam production	2.93E4		
	- Rigid foam production at large sites (ERC 5)		14.35	4.31E3
	- Rigid foam production at small sites (ERC 5)		0.45	136.3
ES4 (PW)	Rigid (spray) foam, professional application	3.63E3		
	- Rigid (spray) foam, professional application, indoor (ERC 8c)		2E-3	-
	- Rigid (spray) foam, professional application, outdoor (ERC 8f)		2E-3	-
ES5 (IS)	Flexible foam production	5.23E3		
	- Flexible foam production at large sites (ERC 5)		6.623	1.99E3
	- Flexible foam production at small sites (ERC 5)		0.873	262
	- Flexible foam cutting (ERC 5)		0.654	196.1
ES6 (IS)	Foam granules and rebound PUR foam	1.22E3		
	- Rebonding of flexible PUR foam (ERC 5)		0.906	271.8
	- Loose crumb (flexible) foam (ERC 5)		0.388	116.5
	- Adhesive pressing (ERC 5)		0.275	26.4
ES7 (PW)	One-component PUR foams, professional application (foaming)	5.78E3		

ES#	Exposure scenario (ES) name and related environmental contributing scenarios	Tonnage per use (t/year)	Daily local tonnage (t/day)	Annual local tonnage (t/year)
	- One-component PUR foams, professional application (foaming), indoor (ERC 8c)		3.18E-3	-
	- One-component PUR foams, professional application (foaming), outdoor (ERC 8f)		3.18E-3	-
ES8 (C)	One-component PUR foams, consumer application (foaming)	3.1E3		
	- One-component PUR foams, consumer application (foaming), indoor (ERC 8c)		1.71E-3	-
	- One-component PUR foams, consumer application (foaming), outdoor (ERC 8f)		1.71E-3	-
ES9 (IS)	CASE, industrial application	179		
	- CASE, industrial application (ERC 5)		8.95	179
ES10 (PW)	CASE, professional application	79		
	- CASE, professional application, indoor (ERC 8c)		4.34E-5	-
	- CASE, professional application, outdoor (ERC 8f)		4.34E-5	-
ES11 (PW)	Laboratory use, professional	1		
	- Wide dispersive indoor use resulting in inclusion into or onto a matrix (ERC 8c)		5.5E-7	-
ES12 (SL)	Rigid foam, service life	4.18E4		
	- Rigid foam, service life (ERC 10a)		0.023	-
	- Adhesive pressed (rigid) foam, service life (ERC 10a)		2.42E-4	-
ES13 (SL)	Flexible foam, service life	5.23E3		
	- Flexible foam, service life (ERC 10a)		2.45E-3	-
	- Rebonded (flexible) foam, service life (ERC 10a)		3.02E-4	-
	- Loose crumb (flexible) foam, service life (ERC 10a)		1.29E-4	-

9.0.3.2. Scope and type of assessment for the environment

The scope of exposure assessment and type of risk characterisation required for the environment are described in the following table based on the hazard conclusions presented in section 7.

Table 9.2. Type of risk characterisation required for the environment

Protection target	Risk characterisation type	Hazard conclusion (see section 7)
Fresh water	Quantitative	PNEC aqua (freshwater) = 0.32 mg/L
Sediment (freshwater)	Quantitative	PNEC sediment (freshwater) = 11.5 mg/kg sediment dw
Marine water	Quantitative	PNEC aqua (marine water) = 0.032 mg/L

Protection target	Risk characterisation type	Hazard conclusion (see section 7)
Sediment (marine water)	Quantitative	PNEC sediment (marine water) = 1.15 mg/kg sediment dw
Sewage Treatment Plant	Quantitative	PNEC STP = 19.1 mg/L
Air	Not needed	No hazard identified
Agricultural soil	Quantitative	PNEC soil = 0.34 mg/kg soil dw
Predator's prey (freshwater)	Quantitative	PNEC oral = 11.6 mg/kg food
Predator's prey (marine water)	Quantitative	PNEC oral = 11.6 mg/kg food
Top predator's prey (marine water)	Quantitative	PNEC oral = 11.6 mg/kg food
Predator's prey (terrestrial)	Quantitative	PNEC oral = 11.6 mg/kg food

9.0.3.3. Fate and distribution parameters

Physicochemical properties used for exposure estimation

The following substance properties are used in the fate estimation done by EUSES. They correspond to the "value used for CSA" reported in sections 1 and 4.

Table 9.3. Substance key phys-chem and fate properties

Substance property	Value
Molecular weight	≥ 327.6
Molecular weight used for the assessment	327.6
Melting point at 101 325 Pa	-20 °C
Vapour pressure	1.4E-5 hPa at 25 °C
Partition coefficient (Log Kow)	2.68 at 30 °C
Water solubility	1.08 g/L at 20 °C
Henry's law constant (in Pa m3/mol)	4.2E-4 at 25 °C
Biodegradation in water: screening tests	inherently biodegradable
Bioaccumulation: BCF (aquatic species)	14 dimensionless
Bioaccumulation: BCF (terrestrial species)	6.58 dimensionless
Degradation rate constant with OH radicals	4.48E-11 cm^3 molecule-1 s-1
Half-life in air (phototransformation)	0.358 d
Half-life for hydrolysis	1 yr at 25 °C
Adsorption/Desorption: Koc at 20 °C	324.2

Caution: The exposure estimates have been obtained with EUSES although the following parameter(s) is/are outside the boundaries of the EUSES model:

Half-life in air (phototransformation)

Fate (release percentage) in the modelled biological sewage treatment plant

In a standard (modelled) biological STP, the emissions are distributed in the following way:

Release to water	96.11%

Release to air	3.83E-4%
Release to sludge	3.887%
Release degraded	0%

The above fractions are calculated by the SIMPLETREAT model integrated in EUSES.

9.0.3.4. Comments on assessment approach for the environment

The regional concentrations are reported in section 10.2.1.1. The local Predicted Exposure Concentrations (PECs) reported for each contributing scenario correspond to the sum of the local concentrations (Clocal) and the regional concentrations (PEC regional).

Environmental exposure assessments have been performed using EUSES 2.1.2 which is part of Chemical Safety Assessment and Reporting tool version 3.3 (Chesar v3.3). For a detailed description of the tool is referred to the Chesar website http://chesar.echa.europa.eu.

However, in most of the environmental contributing scenarios the assessment is not based on ECHA default release factors. Instead release factors based on confidential data provided by the members of the 'TCPP REACH consortium' and emission fractions defined in the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) have been taken into account. This is noted per contributing scenario.

9.0.3.5. Scope and type of assessment for man via environment

The scope of exposure assessment and type of risk characterisation required for man via the environment are described in the following table based on the hazard conclusions presented in section 5.11.

Table 9.4. Type of risk characterisation required for man via the environment

Route of exposure and type of effects	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation: Long term, Systemic	Quantitative	DNEL (Derived No Effect Level) = 1.45 mg/m³
Oral: Long term, Systemic	Quantitative	DNEL (Derived No Effect Level) = 0.52 mg/kg bw/day

9.0.3.6. Comments on assessment approach for man via the environment

Assessments regarding exposure of man via the environment have been performed using EUSES 2.1.2 which is part of Chemical Safety Assessment and Reporting tool version 3.3 (Chesar v3.3). For a detailed description of the tool is referred to the Chesar website http://chesar.echa.europa.eu.

However, in most of the environmental contributing scenarios the assessment is not based on ECHA default release factors. Instead release factors based on confidential data provided by the members of the 'TCPP REACH consortium' and emission fractions defined in the TCPP EU RAR (ECB, 2008) have been taken into account. This is noted per contributing scenario.

9.0.4. Introduction to the assessment for workers

9.0.4.1. Scope and type of assessment for workers

The scope of exposure assessment and type of risk characterisation required for workers are described in the following table based on the hazard conclusions presented in section 5.11.

Table 9.5. Type of risk characterisation required for workers

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 8.2 mg/m³
	Systemic effects - acute	Quantitative	DNEL (Derived No Effect Level) = 22.6 mg/m³
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Dermal	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 2.91 mg/kg bw/day

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
	Systemic effects - acute	Not needed	No DNEL required: short term exposure controlled by conditions for long-term
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Eye	Local effects	Not needed	No hazard identified

9.0.4.2. Comments on assessment approach for workers

Assessment approach related to toxicological hazard:

The most critical hazard assessment conclusions for TCPP are the available derived no-effect levels (DNELs) for long-term systemic effects via inhalation and dermal route. It is anticipated that the long-term systemic DNELs cover the acute/short-term systemic and the local effects via inhalation and dermal route.

Therefore, quantitative assessments regarding long-term systemic inhalation and dermal exposure have been performed.

First tier quantitative worker exposure assessment:

The first tier worker exposure assessments have at first instance been performed using TRA Workers 3.0 which is part of Chemical Safety Assessment and Reporting tool version 3.3 (Chesar 3.3). For a detailed description of the tool is referred to the Chesar website http://chesar.echa.europa.eu.

Some worker contributing scenarios describe the handling of solid products containing TCPP. It is assumed that this form of exposure could best be assessed by using an estimate for solids. Since this is outside the scope of TRA Workers 3.0 the corresponding assessments have been performed using ECETOC TRA version 3.1 (ECETOC TRA 3.1). This is noted per contributing scenario.

For a detailed description of the model is referred to the ECHA guidance on information requirements and chemical safety assessment Chapter R.14: Occupational exposure estimation (version 3.0, August 2016) and to the ECETOC TRA website http://www.ecetoc.org/tra.

Second tier quantitative exposure assessments:

For some worker contributing scenarios second tier worker exposure assessments have been performed if safe use was not demonstrated using first tier assessments. Higher tier assessments were also performed if the risk management measures (RMMs) and operational conditions (OCs) necessary to demonstrate safe use in first tier assessments were not considered reasonable (i.e. too restrictive or too much dependent on respiratory protection equipment (RPE)). If both first tier and higher tier assessments were performed, the assessments leading to safe use assuming the most reasonable combination of RMMs and OCs was described in the CSR.

For higher tier inhalation exposure assessments the Advanced Reach Tool version 1.5 (ART 1.5) was used. ART is a second tier model, which was developed for higher tier exposure assessment generating scientifically justified and realistic exposure estimates. For a detailed description of the model refer to the ECHA guidance on information requirements and chemical safety assessment Chapter R.14: Occupational exposure estimation (version 3.0, August 2016) and to the ART website http://www.advancedreachtool.com.

For some higher tier worker exposure assessments ConsExpo version 4.1 (ConsExpo 4.1) adapted for worker was used. The ConsExpo tool is well-known for consumer exposure assessment which is considered suitable to assess worker exposure for some specific activities that do not deviate much from the corresponding consumer activity. For a detailed description of the model refer to the ECHA guidance on information requirements and chemical safety assessment Chapter R.15: Consumer exposure estimation (version 3.0, July 2016) and to the ConsExpo website www.consexpo.nl.

Assessment approach related to physicochemical hazard:

For TCPP no physicochemical hazards have been identified.

Therefore no specific assessments regarding physicochemical hazards have been performed.

9.0.5. Introduction to the assessment for consumers

9.0.5.1. Scope and type of assessment for consumers

The scope of exposure assessment and type of risk characterisation required for consumers are described in the following table based on the hazard conclusions reported and justified in section 5.11.

Table 9.6. Type of risk characterisation required for consumers

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 1.45 mg/m³
	Systemic effects - acute	Quantitative	DNEL (Derived No Effect Level) = 5.6 mg/m³
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Dermal	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 1.04 mg/kg bw/day
	Systemic effects - acute	Not needed	No DNEL required: short term exposure controlled by conditions for long-term
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Oral	Systemic effects - long term	Quantitative	DNEL (Derived No Effect Level) = 0.52 mg/kg bw/day
Eye	Local effects	Not needed	No hazard identified

9.0.5.2. Comments on assessment approach for consumers

Further information on assessment approach for consumers:

Consumers do not handle TCPP itself. However, exposure to TCPP may occur from the use of one-component PUR foams or products (articles) containing TCPP (service life).

A quantitative assessment regarding inhalation, dermal and oral exposure has been performed. To assess the exposure of consumers during service life either measured data published in the TCPP EU RAR (ECB, 2008) or by Ingerowski et al., 2001 or tier 1 exposure assessments using ConsExpo version 4.1 (ConsExpo 4.1) was used.

The ConsExpo tool is well-known for consumer exposure assessment. For a detailed description of the model refer to the ECHA guidance on information requirements and chemical safety assessment Chapter R.15: Consumer exposure estimation (version 3.0, July 2016) and to the ConsExpo website www.consexpo.nl.

9.1. Exposure scenario 1: Manufacture - Manufacture of TCPP

Environment contributing scenario(s):		
CS 1	Manufacture of TCPP	ERC 1
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	PROC 1
CS 3	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 4	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3
CS 5	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b
CS 6	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9
CS 7	Use as laboratory reagent	PROC 15

Further description of the use:

TCPP is manufactured by reacting phosphorus oxychloride with propylene oxide followed by purification. The complete manufacturing process takes place in closed systems, because 1.) the reaction is carried out in a closed reactor, 2.) the crude product is washed and consequently dehydrated in a closed vessel to remove acidic impurities and residual catalyst, 3.) all transfers are done using closed lines, 4.) the product is filtered, transferred and packaged using sealed pumps and 5.) TCPP is stored in closed vessels under nitrogen, in order to exclude moisture and oxygen (ECB, 2008).

The TCPP EU RAR relied on the total EU production volume from four production sites (three in Germany and one in the UK) in the year 2000 (i.e. 36000 tonnes TCPP).

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production, export and import on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP manufactured by the consortium members in the EU is approx. 48000 tonnes.

9.1.1. Env CS 1: Manufacture of TCPP (ERC 1)

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers intended to provide a Chemical Safety Assessment (CSA) that can be considered representative for the EU TCPP market.

In order to achieve this data concerning production and identified uses are provided on a strictly confidential basis to the consortium management.

However, for the Exposure Scenario covering the manufacture of TCPP no break down to annual tonnage per site is performed, because this would result in an infringement of competition law.

Given the small number of production sites in the EU a break down to annual tonnage per site would allow the consortium members to conclude on competitors annual tonnage.

Therefore, for a worst-case scenario it is assumed that the total volume of TCPP manufactured in the EU is produced at one site.

9.1.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 48000 tonnes/year *Due to reasons of potential infringement of competition law no break down to the largest tonnage per site is performed.* *Therefore, for a worst-case scenario it is assumed that the total volume of TCPP manufactured in the EU is produced at one site.*
• Daily use amount at site: <= 145.5 tonnes/day

Based on the confidential data provided by the members of the 'TCPP REACH consortium' TCPP is produced in the EU 330 days per year. Taking into account the worst-case annual tonnage per site of 48000 tonnes it can be concluded that worst case 145.45 tonnes TCPP are produced per day.
• Percentage of EU tonnage used at regional scale: = 100.0 %
Conditions and measures related to biological sewage treatment plant
• Biological STP: None [Effectiveness Water: 0%] *Based on the confidential data provided by the members of the 'TCPP REACH consortium' all EU TCPP production sites are connected to an on-site STP.*
• On-site STP: Yes [Effectiveness Water: 95%] *Based on the confidential data provided by the members of the 'TCPP REACH consortium' a minimum effectiveness of 95% can be assumed for the on-site STP.*
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Discharge rate of effluent: >= 20000 m3/day *To assess the dilution factor (receiving surface water flow rate / discharge rate STP) the EU TCPP manufacturer having the smallest dilution rate was taken for assessment as reasonable worst case.* *Based on the confidential data provided by the members of the 'TCPP REACH consortium' the concerned on-site STP has a discharge rate of 20000 m3/day.*
• Discharge to: Freshwater only *Based on the confidential data provided by the members of the 'TCPP REACH consortium' no EU TCPP production site is located in a coastal area.*
• Receiving surface water flow rate: >= 4750000 m3/day *To assess the dilution factor (receiving surface water flow rate / discharge rate STP) the EU TCPP manufacturer having the smallest dilution rate was taken for assessment as reasonable worst case.* *Based on the confidential data provided by the members of the 'TCPP REACH consortium' the concerned receiving surface water has a flow rate of 4750000 m3/day.*

9.1.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.7. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor ('TCPP REACH consortium')	**Release factor before on site RMM:** 7E-5% **Release factor after on site RMM:** 3.5E-6% **Local release rate:** 5.09E-3 kg/day **Explanation:** The emission fraction to wastewater is defined based on the confidential data provided by the members of the 'TCPP REACH consortium'. The highest release factor to wastewater calculated for the individual EU TCPP manufacturers is taken for assessment as worst case. Please note, that the release factor is based on measured data and takes into account all implemented risk management measures prior to STP.

Release	Release estimation method	Explanations
Air	Estimated release factor ('TCPP REACH consortium')	**Release factor before on site RMM:** 1E-6% **Release factor after on site RMM:** 1E-6% **Local release rate:** 1.45E-3 kg/day **Explanation:** The emission fraction to air is defined based on the confidential data provided by the members of the 'TCPP REACH consortium'. The highest release factor to air calculated for the individual EU TCPP manufacturers is taken for assessment as worst case. Please note that off-air from TCPP production is treated prior to release to the environment. The indicated release factor reflects all implemented risk management measures towards off-air on site.
Non agricultural soil	Estimated release factor ('TCPP REACH consortium')	**Release factor after on site RMM:** 0% **Explanation:** Based on the confidential data provided by the members of the 'TCPP REACH consortium' no direct release of TCPP to (industrial) soil occurs.

Releases to waste

Release factor to external waste: 5 %

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 48000 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 2400 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 240 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 240 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

9.1.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have

been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.8. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.15E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.12E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.11E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.57E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 3.78E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 7.47E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.1.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)

9.1.2.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]	TRA Workers 3.0

	Method
Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.1.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.9. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	3.4E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.018
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.1.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

9.1.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.1.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.10. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.047
Combined routes, systemic, long-term		RCR = 0.106
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.1.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

9.1.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	

	Method
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.1.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.11. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.069 mg/kg bw/day (TRA Workers)	RCR = 0.024
Combined routes, systemic, long-term		RCR = 0.083
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.1.5. Worker CS 5: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b)

9.1.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.1.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.12. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.1.6. Worker CS 6: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)

9.1.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.1.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.13. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.295
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.1.7. Worker CS 7: Use as laboratory reagent (PROC 15)

9.1.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0

	Method
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is typically handled under LEV (e.g. fume cupboard).*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Operating temperature: <= 40.0 °C	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

9.1.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.14. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.071
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2. Exposure scenario 2: Formulation or re-packing - Formulation into mixture

Environment contributing scenario(s):		
CS 1	Formulation into mixture	ERC 2
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions	PROC 1
CS 3	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 4	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities	PROC 8a
CS 8	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b
CS 9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9
CS 10	Use as laboratory reagent	PROC 15

9.2.1. Env CS 1: Formulation into mixture (ERC 2)

According to the TCPP EU RAR most TCPP (over 98%) is used as a flame retardant in the production of polyurethane (PUR) for use in construction and furniture. PUR is produced from the reaction of di-isocyanates with polyols. TCPP can be added to polyols in the production of PUR systems, or added directly at the point of foaming.

While some PUR producers buy polyols, di-isocyanates and other raw materials direct from manufacturers, others purchase pre-mixed, ready-to-use PUR systems. PUR systems consist of a polyol component (mixture of polyols, catalysts and other additives such as TCPP) and a di-isocyanate component (di-isocyanate or a di-isocyanate containing pre-polymer) (ECB, 2008).

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in so-called systems houses (i.e. 20450 tonnes TCPP), that manufacture PUR systems (i.e. 16600 tonnes TCPP) and spray foams (i.e. 3850 tonnes TCPP). The authors concluded that formulations of PUR systems and spray foams are so similar that they are assessed together in the risk assessment (ECB, 2008).

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning formulation of PUR systems on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP used in formulation of PUR systems was 20560 tonnes.

Please note that in contrast to the TCPP EU RAR production of one-component foams (1-K foams) that are produced in closed loop systems are considered to be covered by this Exposure Scenario.

9.2.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 4112 tonnes/year *As a reasonable worst case it is assumed that 50% of the TCPP formulated at systems houses is used at one industrial site [F(local) = 0.5].*
• Daily use amount at site: <= 13.7 tonnes/day *The number of (production) days per year for formulating PUR systems at large systems houses is discussed in the Confidential Annex of the TCPP EU RAR. However, the authors of the TCPP EU RAR indicate that medium sized and small systems houses and systems houses using pre-formulated polyol manufacture PUR systems (at least) 300 days per year (ECB, 2008). Therefore, in line with the ECHA guidance R.16: Environmental Exposure*

Estimation (version 3.0, February 2016) it is considered reasonable to assume 300 release days for TCPP formulation at systems houses in general.
• Percentage of EU tonnage used at regional scale: = 40.0 % *The authors of the TCPP EU RAR differentiate between formulation of TCPP at large, medium sized and small systems houses and at systems houses using pre-formulated polyol.* *The tonnage of TCPP formulated at large systems houses and the corresponding fraction in the main region (= percentage of EU tonnage used at regional scale) are discussed in the Confidential Annex of the TCPP EU RAR.* *However, according to the TCPP EU RAR large, medium sized and small systems houses each account for 30% to 35% of the TCPP consumed, whereas systems houses using pre-formulated polyol account for only 1% of the TCPP consumed (ECB, 2008).* *For reasons of simplification it can be assumed that approximately one third (33%) of the total tonnage of TCPP is formulated at large systems houses. Therefore, as a reasonable worst case for formulation at systems houses the fraction in the main region was set to F(region) = 0.4.*
Technical and organisational conditions and measures
• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP is only formulated at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]
• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.2.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.15. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.025% **Release factor after on site RMM:** 0.025% **Local release rate:** 3.428 kg/day **Explanation:**

Release	Release estimation method	Explanations
		The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). The releases from formulation of TCPP at large systems houses are discussed in the Confidential Annex of the TCPP EU RAR. However, as a reasonable worst case it is assumed that releases to the environment are similar to those from formulation of TCPP at medium or small systems houses.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.025% **Release factor after on site RMM:** 0.025% **Local release rate:** 3.428 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). The releases from formulation of TCPP at large systems houses are discussed in the Confidential Annex of the TCPP EU RAR. However, as a reasonable worst case it is assumed that releases to the environment are similar to those from formulation of TCPP at medium or small systems houses.
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 2.5 %

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 20560 t/y

Fraction of substance becoming waste*): 2.5%

Amount if substance in waste: 514 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 51.4 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 51.4 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 kg/y

Default release factor to soil*): 0

Amount of substance to soil: 0 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

9.2.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.16. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.165 mg/L	RCR = 0.515
Sediment (freshwater)	**Local PEC:** 5.934 mg/kg dw	RCR = 0.516
Marine water	**Local PEC:** 0.016 mg/L	RCR = 0.515
Sediment (marine water)	**Local PEC:** 0.593 mg/kg dw	RCR = 0.516
Sewage Treatment Plant	**Local PEC:** 1.647 mg/L	RCR = 0.086
Agricultural soil	**Local PEC:** 7.95E-3 mg/kg dw	RCR = 0.023
Predator's prey (freshwater)	**Local PEC:** 0.949 mg/kg ww	RCR = 0.082
Predator's prey (marine water)	**Local PEC:** 0.095 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 0.019 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 4.07E-3 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 7.83E-4 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 0.096 mg/kg bw/day	RCR = 0.186
Man via environment - combined routes		RCR = 0.186

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.2.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions (PROC 1)

9.2.2.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.17. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	3.4E-3 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.018
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

9.2.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	

	Method
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.18. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.137 mg/kg bw/day (TRA Workers)	RCR = 0.047
Combined routes, systemic, long-term		RCR = 0.106
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

9.2.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.19. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.069 mg/kg bw/day (TRA Workers)	RCR = 0.024
Combined routes, systemic, long-term		RCR = 0.083
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)

9.2.5.1. Conditions of use

	Method
Product (Article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.20. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.295
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)

9.2.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0

	Method
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.21. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.7. Worker CS 7: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a)

9.2.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0

	Method
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.22. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b)

9.2.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.23. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9)

9.2.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.2.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.24. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.295
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.2.10. Worker CS 10: Use as laboratory reagent (PROC 15)

9.2.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is typically handled under LEV (e.g. fume cupboard).*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Operating temperature: <= 40.0 °C	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

9.2.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.25. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.028
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3. Exposure scenario 3: Use at industrial sites - Rigid foam production

Market sector: Rigid foam production

Product category used: PC 32: Polymer Preparations and Compounds

Sector of use: SU 12: Manufacture of plastics products, including compounding and conversion; SU 19: Building and construction work

Environment contributing scenario(s):		
CS 1	Rigid foam production at large sites	ERC 5
CS 2	Rigid foam production at small sites	ERC 5
Worker contributing scenario(s):		
CS 3	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 1
CS 4	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 2
CS 5	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %.	PROC 3
CS 6	Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %.	PROC 4
CS 7	Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %.	PROC 5
CS 8	Industrial spraying	PROC 7
CS 9	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 10	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 11	Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %.	PROC 9
CS 12	Use as laboratory reagent; Covers percentage substance in the product up to 100 %.	PROC 15
CS 13	Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %.	PROC 21

Subsequent service life exposure scenario(s):

ES12: Service life (consumers) - Rigid foam, service life

Further description of the use:

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning formulation of PUR systems and production of rigid foam on a strictly confidential basis to the consortium management. Based on the provided information PUR systems are used for 'Rigid foam production', 'Rigid (spray) foam, professional applications', 'One-component PUR foams' and 'CASE applications'. In the year 2015 the total volume of TCPP used in the production of rigid foam was 29320 tonnes.

Taking into account the total volume of TCPP used in formulation of PUR systems (e.g. 20560 tonnes) and the volume of TCPP used in PUR systems for 'Rigid (spray) foam, professional applications' (e.g. 3631 tonnes),'One-component PUR foams' (e.g. 8880 tonnes) and

'CASE applications' (e.g. 258 tonnes) it is assumed that in the year 2015 the total volume of TCPP used in the production of rigid foam was 21529 tonnes at large production sites and 7791 tonnes at small production sites.

9.3.1. Env CS 1: Rigid foam production at large sites (ERC 5)

9.3.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 4306 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 1*
• Daily use amount at site: <= 14.3 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 20.0 % *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.2*
Technical and organisational conditions and measures
• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing foam is only produced at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]
• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.3.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.26. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4.8E-6% **Release factor after on site RMM:** 4.8E-6% **Local release rate:** 6.89E-4 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4.8E-6% **Release factor after on site RMM:** 4.8E-6% **Local release rate:** 6.89E-4 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 1.5 %

It is assumed that all rigid foam disposal generated at large industrial sites is either recycled or treated by waste incineration:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 21271 t/y

Fraction of substance becoming waste according to the TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 319.1 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 31.9 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 31.9 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 kg/y

Default release factor to soil*): 0

Amount of substance to soil: 0 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

9.3.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.27. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.47E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 5.28E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.44E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 5.18E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 3.31E-4 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.09E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.78E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.74E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.59E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.56E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.7E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 5.2E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.3.2. Env CS 2: Rigid foam production at small sites (ERC 5)

9.3.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 136.3 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.175*
• Daily use amount at site: <= 0.45 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 10.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.1*
Technical and organisational conditions and measures
• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing foam is only produced at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]

• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.3.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.28. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.01% **Release factor after on site RMM:** 0.01% **Local release rate:** 0.045 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). Please note that for small sites the TCPP EU RAR included an additional release of 0.01% to wastewater from handling of raw materials.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4.8E-6% **Release factor after on site RMM:** 4.8E-6% **Local release rate:** 2.16E-5 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 1.5 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 3895.5 t/y

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount of substance in waste: 58.4 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 5.8 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 5.8 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 3895.5 t/y

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 58.4 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 96.6 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.23%

Amount of TCPP to water: 18.3 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 96.6 kg/y released to soil is considered. The calculation of waste water effluent of 18.3 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.3.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.29. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 2.28E-3 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 0.082 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 2.27E-4 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 8.19E-3 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0.022 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 0.014 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.41E-3 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 4.06E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.76E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 1.26E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.3.3. Worker CS 3: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 1)

9.3.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 %	TRA Workers 3.0

	Method
The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.	
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: No [Effectiveness Dermal: 0%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.30. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.017
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.4. Worker CS 4: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 2)

9.3.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.31. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.082 mg/kg bw/day (TRA Workers)	RCR = 0.028
Combined routes, systemic, long-term		RCR = 0.088
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.5. Worker CS 5: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %. (PROC 3)

9.3.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is*	TRA Workers 3.0

	Method
prerequisite to ensure safe use.	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.32. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.074
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.6. Worker CS 6: Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %. (PROC 4)

9.3.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	

	Method
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.33. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.412 mg/kg bw/day (TRA Workers)	RCR = 0.141
Combined routes, systemic, long-term		RCR = 0.151
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.7. Worker CS 7: Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %. (PROC 5)

9.3.7.1. Conditions of use

	Method
Product (Article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.34. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.293
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.8. Worker CS 8: Industrial spraying (PROC 7)

9.3.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly in the spray nozzle by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is required to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure efficiency of the applied dermal protection specific activity training is required.*	TRA Workers 3.0
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *When TCPP containing aerosols can be formed operators are advised to wear self-sustained breathing apparatus or air-supplied masks in order to reduce inhalation exposure significantly.*	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.3.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.35. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	2.047 mg/m³ (TRA Workers)	RCR = 0.25

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, acute	8.189 mg/m³ (TRA Workers)	RCR = 0.362
Dermal, systemic, long term	1.286 mg/kg bw/day (TRA Workers)	RCR = 0.442
Combined routes, systemic, long-term		RCR = 0.692
Combined routes, systemic, acute		RCR = 0.362

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.9. Worker CS 9: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.3.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.3.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.36. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.488
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.10. Worker CS 10: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.3.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.3.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.37. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.48
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.11. Worker CS 11: Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %. (PROC 9)

9.3.11.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.3.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.38. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.252
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.12. Worker CS 12: Use as laboratory reagent; Covers percentage substance in the product up to 100 %. (PROC 15)

9.3.12.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is often handled in the presence of diisocyanates (e.g. MDI) and pentane for which handling under LEV (e.g. fume cupboard) is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0

	Method
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.3.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.39. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.071
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.3.13. Worker CS 13: Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %. (PROC 21)

9.3.13.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	ECETOC TRA 3.1
• Physical form of the used product: Solid (medium dusty form) *Pure TCPP is a liquid. However, in this task TCPP is included into or onto a matrix. Exposure estimation is therefore based on solid state. Dust formation (if any) is assumed to be limited. Therefore, handling of a medium dusty solid during this task is taken as worst case.*	ECETOC TRA 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	ECETOC TRA 3.1
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA 3.1

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ECETOC TRA 3.1
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA 3.1
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.* *Cutting of foam is done at <= 40°C.*	ECETOC TRA 3.1

9.3.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.40. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.8 mg/m³ (ECETOC TRA 3.1)	RCR = 0.22
Inhalation, systemic, acute	7.2 mg/m³ (ECETOC TRA 3.1)	RCR = 0.319
Dermal, systemic, long term	0.17 mg/kg bw/day (ECETOC TRA 3.1)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.278
Combined routes, systemic, acute		RCR = 0.319

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4. Exposure scenario 4: Widespread use by professional workers - Rigid (spray) foam, professional application

Sector of use: SU 19: Building and construction work

Environment contributing scenario(s):		
CS 1	Rigid (spray) foam, professional application, indoor	ERC 8c
CS 2	Rigid (spray) foam, professional application, outdoor	ERC 8f
Worker contributing scenario(s):		
CS 3	Mixing or blending in batch processes; Covers percentage substance in the product up to 15 %.	PROC 5
CS 4	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 5	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 6	Roller application or brushing; Covers percentage substance in the product up to 15 %.	PROC 10
CS 7	Non-industrial spraying; Covers percentage substance in the product up to 15 %.	PROC 11
CS 8	Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 15 %.	PROC 21

Subsequent service life exposure scenario(s):

ES12: Service life (consumers) - Rigid foam, service life

Further description of the use:

Spray foams are surface-adapted technical insulation materials for roofs, interior spaces and technical applications that are used in building construction and maintenance and repair (ECB, 2008).

The authors of the TCPP EU RAR indicate that spray foams in general are used by workers in small companies (up to ten employees), who purchase formulated PUR systems ready for use. Spray foams are formulated by systems houses and are usually applied in situ to walls, roofs, tanks and pipes. Most applications are external but some are inside buildings (ECB, 2008).

According to the TCPP EU RAR spray foams are not available for use by the general public (ECB, 2008).

More details on use of spray foam can be found in Appendix A (Section 5) of the TCPP EU RAR.

In the TCPP EU RAR it is concluded that based on an uncovered foam (at the time of spraying) the loss rate from foaming in situ (e.g. insulation of roofs) can be estimated as 0.00066% per day (i.e. 0.24% over the year). Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 9.6E-02% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in spray foam systems in Europe (i.e. 3850 tonnes TCPP).

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning spray foam systems on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP used in spray foam systems was 3631 tonnes.

9.4.1. Env CS 1: Rigid (spray) foam, professional application, indoor (ERC 8c)

9.4.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.002 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %

Technical and organisational conditions and measures
• Indoor/outdoor use: Indoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*

9.4.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.41. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 1.5 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 1815.5 tonnes/year

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 27.2 t/

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 2.7 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 2.7 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP the release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 1815.5 t/y

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 27.2 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 43.5 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.11%

Amount of TCPP to water: 8.5 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 43.5 kg/y released to soil is considered. The calculation of waste water effluent of 8.5 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.4.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have

been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.42. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.4.2. Env CS 2: Rigid (spray) foam, professional application, outdoor (ERC 8f)

9.4.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.002 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Technical and organisational conditions and measures
• Indoor/outdoor use: Outdoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*

9.4.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.43. Local releases to the environment

Release	Release estimation method	Explanations

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 1.5 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 1815.5 tonnes/year

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 27.2 t/

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 2.7 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 2.7 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP the release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 1815.5 t/y

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 1.5%

Amount if substance in waste: 27.2 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 43.5 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.11%

Amount of TCPP to water: 8.5 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 43.5 kg/y released to soil is considered. The calculation of waste water effluent of 8.5 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.4.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.44. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.4.3. Worker CS 3: Mixing or blending in batch processes; Covers percentage substance in the product up to 15 %. (PROC 5)

9.4.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 15.0 % *The TCPP content depends on the foam grade and varies between 0 and 30% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 15% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0 (modified)
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified)
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0 (modified)
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0 (modified)
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
• Respiratory protection:Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *Specific respiratory protection is not required to ensure safe use. However, operators wear respiratory protection (e.g.*	TRA Workers 3.0 (modified)

	Method
wear self-sustained breathing apparatus or air-supplied masks) as TCPP is handled in the presence of diisocyanates (e.g. MDI) for which respiratory protection is prerequisite to ensure safe use.	
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional spraying of rigid foam is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0 (modified)
• Operating temperature: <= 40.0 °C	TRA Workers 3.0 (modified)

9.4.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.45. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.041 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Inhalation, systemic, acute	0.041 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Dermal, systemic, long term	0.165 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.057
Combined routes, systemic, long-term		RCR = 0.062
Combined routes, systemic, acute		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4.4. Worker CS 4: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.4.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0 (modified)
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified)
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0 (modified)
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0 (modified)

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *Specific respiratory protection is not required to ensure safe use. However, operators wear respiratory protection (e.g. wear self-sustained breathing apparatus or air-supplied masks) as TCPP is handled in the presence of diisocyanates (e.g. MDI) for which respiratory protection is prerequisite to ensure safe use.*	TRA Workers 3.0 (modified)
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional spraying of rigid foam is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0 (modified)
• Operating temperature: <= 40.0 °C	TRA Workers 3.0 (modified)

9.4.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.46. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.094
Combined routes, systemic, long-term		RCR = 0.103
Combined routes, systemic, acute		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4.5. Worker CS 5: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.4.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0 (modified)
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified)

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified)
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0 (modified)
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0 (modified)
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
• Respiratory protection:Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *Specific respiratory protection is not required to ensure safe use. However, operators wear respiratory protection (e.g. wear self-sustained breathing apparatus or air-supplied masks) as TCPP is handled in the presence of diisocyanates (e.g. MDI) for which respiratory protection is prerequisite to ensure safe use.*	TRA Workers 3.0 (modified)
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0 (modified)
• Operating temperature: <= 40.0 °C	TRA Workers 3.0 (modified)

9.4.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.47. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers 3.0 (modified))	RCR < 0.01
Dermal, systemic, long term	0.274 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.094
Combined routes, systemic, long-term		RCR = 0.103
Combined routes, systemic, acute		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4.6. Worker CS 6: Roller application or brushing; Covers percentage substance in the product up to

15 %. (PROC 10)

9.4.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 15.0 % *The TCPP content depends on the foam grade and varies between 0 and 30% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 15% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0 (modified)
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified)
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified)
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0 (modified)
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0 (modified)
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
• Respiratory protection:Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *Specific respiratory protection is not required to ensure safe use. However, operators wear respiratory protection (e.g. wear self-sustained breathing apparatus or air-supplied masks) as TCPP is handled in the presence of diisocyanates (e.g. MDI) for which respiratory protection is prerequisite to ensure safe use.*	TRA Workers 3.0 (modified)
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional spraying of rigid foam is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0 (modified)
• Operating temperature: <= 40.0 °C	TRA Workers 3.0 (modified)

9.4.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.48. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0 (modified))	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0 (modified))	RCR = 0.022
Dermal, systemic, long term	0.329 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.113
Combined routes, systemic, long-term		RCR = 0.172
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Additional conditions of use related to the exposure estimate:

• Dermal protection: No [Effectiveness Dermal: 0%]

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4.7. Worker CS 7: Non-industrial spraying; Covers percentage substance in the product up to 15 %. (PROC 11)

9.4.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 15.0 % *The TCPP content depends on the foam grade and varies between 0 and 30% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly in the spray nozzle by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 15% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0 (modified) ART 1.5
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified) ART 1.5
• [ART] Viscosity of the substance/preparation: Liquids with medium viscosity (like oil)	ART 1.5
• [ART] Vapour pressure at process temperature: < 0.012 Pa	ART 1.5
• [ART] Activity coefficient: = 1.0	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified) ART 1.5
Technical and organisational conditions and measures	
• [ART] Primary emission source proximity: Primary emission source located in the breathing zone of the worker (Near field source)	ART 1.5
• [ART] Housekeeping practices: Demonstrable and effective housekeeping practices in place	ART 1.5
• [ART] Dispersion - General ventilation: No restriction on general ventilation characteristics	ART 1.5
• [ART] Activity class: Spray application of liquids / Surface spraying of liquids	ART 1.5

	Method
• [ART] Situation: High application rate (> 3 l/minute)	ART 1.5
• [ART] Spray technique: Spraying with high compressed air use	ART 1.5
• [ART] Spray direction: Spraying in any direction (including upwards)	ART 1.5
• [ART] Primary localized controls: No localized controls [Effectiveness Inhalation: 0%]	ART 1.5
• [ART] Secondary emission source: No secondary emission sources present in the workroom in addition to the source in the breathing zone of the worker	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *Operators are advised to wear self-sustained breathing apparatus or air-supplied masks in order to reduce inhalation exposure significantly.*	ART 1.5
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional spraying of rigid foam is performed indoors and outdoors. As a reasonable worst-case indoor spraying is assumed.*	ART 1.5
• [ART] Dispersion - Room size: Any size workroom	ART 1.5
• Operating temperature: <= 60.0 °C	TRA Workers 3.0 (modified)
• [ART] Details Assessment tool: Advanced REACH Tool v1.5 (ART) for inhalation exposure	ART 1.5
• [ART] Deviation from Advanced REACH Tool: yes, the use of respiratory protective equipment (RPE) is assumed	ART 1.5
• [ART] Details Exposure predictions: The predicted values for inhalation exposure refer to the 90th percentile full-shift exposure	ART 1.5

9.4.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.49. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	4 mg/m³ (ART 1.5)	RCR = 0.488
Inhalation, systemic, acute	8 mg/m³ (ART 1.5)	RCR = 0.354
Dermal, systemic, long term	1.286 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.442
Combined routes, systemic, long-term		RCR = 0.93
Combined routes, systemic, acute		RCR = 0.354

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.4.8. Worker CS 8: Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 15 %. (PROC 21)

9.4.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 15.0 % *The TCPP content depends on the foam grade and varies between 0 and 15% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 15% (w/w) for this step can be regarded as reasonable worst case.*	ECETOC TRA 3.1
• Physical form of the used product: Solid (very dusty form) *Pure TCPP is a liquid. However, in this task TCPP is included into or onto a matrix. Exposure estimation is therefore based on solid state. Dust formation is likely. Therefore, handling of a very dusty solid during this task is taken as worst case.*	ECETOC TRA 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	ECETOC TRA 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ECETOC TRA 3.1
• Respiratory protection: Yes (Respirator with APF of 10) [Effectiveness Inhalation: 90%] *Use of respiratory protection equipment is needed to reduce inhalation exposure significantly.*	ECETOC TRA 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional spraying of rigid foam is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	ECETOC TRA 3.1
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.* *Cutting of foam is done at <= 40°C.*	ECETOC TRA 3.1

9.4.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.50. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.2 mg/m³ (ECETOC TRA 3.1)	RCR = 0.146
Inhalation, systemic, acute	4.8 mg/m³ (ECETOC TRA 3.1)	RCR = 0.212
Dermal, systemic, long term	0.17 mg/kg bw/day (ECETOC TRA 3.1)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.205
Combined routes, systemic, acute		RCR = 0.212

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5. Exposure scenario 5: Use at industrial sites - Flexible foam production

Market sector: Flexible foam production

Product category used: PC 32: Polymer Preparations and Compounds

Sector of use: SU 12: Manufacture of plastics products, including compounding and conversion; SU 18: Manufacture of furniture

Environment contributing scenario(s):		
CS 1	Flexible foam production at large sites	ERC 5
CS 2	Flexible foam production at small sites	ERC 5
CS 3	Flexible foam cutting	ERC 5
Worker contributing scenario(s):		
CS 4	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 1
CS 5	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 2
CS 6	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %.	PROC 3
CS 7	Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %.	PROC 4
CS 8	Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %.	PROC 5
CS 9	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 10	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 11	Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %.	PROC 9
CS 12	Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %.	PROC 14
CS 13	Use as laboratory reagent; Covers percentage substance in the product up to 100 %.	PROC 15
CS 14	Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %.	PROC 21

Subsequent service life exposure scenario(s):

ES13: Service life (consumers) - Flexible foam, service life

Further description of the use:

Flexible foam production:

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production of foam foam on a strictly confidential basis to the consortium management. Based on the provided information in the year 2015 the total volume of TCPP used in the production of flexible foam was 5320 tonnes.

According to the TCPP EU RAR around 70% of the TCPP used in flexible foam in the year 2000 (i.e. 4800 tonnes TCPP) is used by 'very-large' foamers that are based in the UK. The remaining 30% of the flexible foam TCPP tonnage is split between 'large' and 'small' sites with some of the latter using systems rather than TCPP directly (ECB, 2008).

The basis of the split is described in the Confidential Annex of the TCPP EU RAR, but can be gauged from the data provided for the respective fractions to the main region and the main local source and the TCPP tonnage handled at the "largest" site. Based on the information available TCPP EU RAR in the year 2000 the share is approximately 26%, 1% and 3% for 'large' sites, 'small' sites directly adding TCPP and 'small' sites using TCPP containing systems (ECB, 2008).

Therefore, it considered reasonable to assume that approximately 95% (e.g. 4968 tonnes) of the TCPP used in flexible foam is consumed at large or very large sites, whereas approximately 5% (e.g. 262 tonnes) of the TCPP used in flexible foam is consumed at small sites directly adding TCPP and small sites using TCPP containing systems.

Flexible foam cutting:

In general, PUR foam blocks have to be cut into the required size and shape of the final product. This operation is performed after the blocks have cured and cooled. However, for some applications (e.g. seats for office furniture), PUR foam can be produced in a mould of the desired shape and so cutting is not required (ECB, 2008).

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in the production of flexible foam in Europe (i.e. 6800 tonnes TCPP equivalent to 18% of the total TCPP use). The authors assumed that worst case all TCPP containing foam requires cutting (ECB, 2008).

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production of flexible foam on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP used in the production of flexible foam was 5230 tonnes. In line with the the TCPP EU RAR it is assumed that worst case all TCPP containing foam requires cutting.

9.5.1. Env CS 1: Flexible foam production at large sites (ERC 5)

The TCPP EU RAR concluded that emissions from handling TCPP at (very) large producers can be considered to be effectively zero owing to the storage of TCPP in large vessels which are located in large bunded areas. TCPP is moved in closed systems and pumped direct from the storage vessels to the mixing head. No water washing is used anywhere on site (ECB, 2008).

The authors further concluded that emissions from foaming to air and water are also effectively zero because the foaming process is enclosed, with all fumes emitted through an activated carbon filter or other abatement methods and water is not used to clean the mixing head or other machinery. When mixing vessels require cleaning, the plant is shut down and a polyol or solvent flush is used. The solvent (e.g. methylene chloride) is used, drummed and sent for re-distillation (ECB, 2008).

However, the TCPP EU RAR identified a potential for TCPP release during curing, since the foam is at elevated temperatures, e.g. up to 150°C for several hours (depending on the size of the block). Foam producers indicated that at any one time, up to 2.5% of the TCPP used at the facility could be present in blocks undergoing curing and storage.

The authors proposed release rates in curing and storage of 1.2E-04% to air and 1.2E-04% to wastewater, which accounts for the finding that for TCPP, only 40% of the substance present is available for release. This is based on a model which brings together theoretical modelling with the findings of various published studies (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.5.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 1987 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.4*
• Daily use amount at site: <= 6.6 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 100.0 %

The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 1
Technical and organisational conditions and measures
• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing foam is only produced at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]
• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.5.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.51. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 1.2E-4% **Release factor after on site RMM:** 1.2E-4% **Local release rate:** 7.95E-3 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 1.2E-4% **Release factor after on site RMM:** 1.2E-4% **Local release rate:** 7.95E-3 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment

Release	Release estimation method	Explanations
		Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 0.2 %

It is assumed that all flexible foam disposal generated at large industrial sites is either recycled or treated by waste incineration:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 4968 t/y

Fraction of substance becoming waste according to the TCPP EU RAR (ECB, 2008): 0.2%

Amount if substance in waste: 9.9 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 1.0 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 1.0 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

9.5.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.52. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 4.95E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 0.018 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 4.92E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 1.77E-3 mg/kg dw	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Sewage Treatment Plant	**Local PEC:** 3.82E-3 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.24E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 3.78E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 3.75E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.99E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.64E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.83E-6 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 2.56E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.5.2. Env CS 2: Flexible foam production at small sites (ERC 5)

The TCPP EU RAR concluded that emissions from handling TCPP at (very) large producers can be considered to be effectively zero owing to the storage of TCPP in large vessels which are located in large bunded areas. TCPP is moved in closed systems and pumped direct from the storage vessels to the mixing head. No water washing is used anywhere on site (ECB, 2008).

The authors further concluded that emissions from foaming to air and water are also effectively zero because the foaming process is enclosed, with all fumes emitted through an activated carbon filter or other abatement methods and water is not used to clean the mixing head or other machinery. When mixing vessels require cleaning, the plant is shut down and a polyol or solvent flush is used. The solvent (e.g. methylene chloride) is used, drummed and sent for re-distillation (ECB, 2008).

However, the TCPP EU RAR identified a potential for TCPP release during curing, since the foam is at elevated temperatures, e.g. up to 150°C for several hours (depending on the size of the block). Foam producers indicated that at any one time, up to 2.5% of the TCPP used at the facility could be present in blocks undergoing curing and storage.

The authors proposed release rates in curing and storage of 1.2E-04% to air and 1.2E-04% to wastewater, which accounts for the finding that for TCPP, only 40% of the substance present is available for release. This is based on a model which brings together theoretical modelling with the findings of various published studies (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

An addition to the releases in curing and storage the TCPP EU RAR included a release of 0.01% to wastewater from handling of raw materials for small sites.

9.5.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 262.0 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 1*
• Daily use amount at site: <= 0.87 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 100.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 1*
Technical and organisational conditions and measures

• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing foam is only produced at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]
• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.5.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.53. Local releases to the environment

Release	**Release estimation method**	**Explanations**
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.01% **Release factor after on site RMM:** 0.01% **Local release rate:** 0.088 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). Please note that for small sites the TCPP EU RAR included an additional release of 0.01% to wastewater from handling of raw materials.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 1.2E-4% **Release factor after on site RMM:** 1.2E-4% **Local release rate:** 1.05E-3 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP	**Release factor after on site RMM:** 0%

Release	Release estimation method	Explanations
	EU RAR)	**Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 0.2 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 131.0 t/y

Fraction of substance becoming waste according to the TCPP EU RAR (ECB, 2008): 0.2%

Amount if substance in waste: 262 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 26.2 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 26.2 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 131t/y

Fraction of substance becoming waste, TCPP EU RAR (ECB, 2008): 0.2%

Amount if substance in waste: 262 kg/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 419 g/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.001%

Amount of TCPP to water: 81.8 g/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 419 g/y released to soil is considered. The calculation of waste water effluent of 81.8 g/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.5.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.54. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 4.36E-3 mg/L	RCR = 0.014
Sediment (freshwater)	**Local PEC:** 0.157 mg/kg dw	RCR = 0.014
Marine water	**Local PEC:** 4.36E-4 mg/L	RCR = 0.014
Sediment (marine water)	**Local PEC:** 0.016 mg/kg dw	RCR = 0.014
Sewage Treatment Plant	**Local PEC:** 0.042 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.1E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 0.026 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 2.6E-3 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 6.44E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.56E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 2.52E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 2.4E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.5.3. Env CS 3: Flexible foam cutting (ERC 5)

The authors of the TCPP EU RAR identified potential losses of TCPP to the environment associated with the cutting of slabstock foams

during cutting and trimming processes and manufacture of furniture. A consultation with industry indicated that dusts are collected at the point of cutting by extractors attached to the blade. Nevertheless, it could still be the case that a small proportion of dusts and small pieces of foam are exposed to air and hence some TCPP could be released on a local scale. The authors of the TCPP EU RAR reference a study undertaken by EUROPUR that has established that up to 0.1% of foam is lost as dust and non-recycled offcut pieces. The authors of the TCPP EU RAR estimated that 1% of this material might not be collected by the extractor systems. These pieces of TCPP containing foam could release TCPP into the workplace air and could reach the environment via air and also wastewater (e.g. via adsorption and cleaning) (ECB, 2008).

The authors proposed release rates from cutting of foam of 2E-04% to air and 2E-04% to wastewater, which accounts for the finding that for TCPP, only 40% of the substance present is available for release. This is based on a model which brings together theoretical modelling with the findings of various published studies (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

More information on the production of flexible foam for furniture can be found in Appendix A (Section 2) of the TCPP EU RAR.

9.5.3.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 196.1 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.05*
• Daily use amount at site: <= 0.65 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 75.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.75*
Technical and organisational conditions and measures
• Extractor system in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing flexible foam is only cut at sites where an extractor system is in place with efficiency of 99% or better regarding removal of dust and/or non-recycled offcut pieces (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
• Application of the STP sludge on agricultural soil: Yes
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

9.5.3.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.55. Local releases to the environment

Release	Release estimation method	Explanations

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 2E-4% **Release factor after on site RMM:** 2E-4% **Local release rate:** 1.31E-3 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 2E-4% **Release factor after on site RMM:** 2E-4% **Local release rate:** 1.31E-3 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected.

Releases to waste

Release factor to external waste: 0.1 %

50% incineration assumed in parallel to rigid foam [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 2615 t/y

Fraction of substance becoming waste according to the TCPP EU RAR (ECB, 2008): 0.1%

Amount if substance in waste: 2615 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 261 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 261 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 2615 t/y

Fraction of substance becoming waste, TCPP EU RAR: 0.1%

Amount if substance in waste: 2615 kg/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 4.18 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.01%

Amount of TCPP to water: 817 g/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 4.18 kg/y released to soil is considered. The calculation of waste water effluent of 817 g/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.5.3.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.56. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.76E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 6.35E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.74E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 6.25E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 6.28E-4 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 9.81E-4 mg/kg dw	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Predator's prey (freshwater)	**Local PEC:** 1.95E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.91E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.62E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 6.26E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 3.11E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 7.39E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.5.4. Worker CS 4: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 1)

9.5.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: No [Effectiveness Dermal: 0%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.57. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.017
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.5. Worker CS 5: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 2)

9.5.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	

	Method
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.58. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.082 mg/kg bw/day (TRA Workers)	RCR = 0.028
Combined routes, systemic, long-term		RCR = 0.088
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.6. Worker CS 6: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %. (PROC 3)

9.5.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0

	Method
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.59. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.074
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.7. Worker CS 7: Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %. (PROC 4)

9.5.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 %	TRA Workers 3.0

	Method
The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.	
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.60. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.412 mg/kg bw/day (TRA Workers)	RCR = 0.141
Combined routes, systemic, long-term		RCR = 0.151
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.8. Worker CS 8: Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %. (PROC 5)

9.5.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.61. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk quantification
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.293
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.9. Worker CS 9: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.5.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.5.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.62. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.488
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.10. Worker CS 10: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.5.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.5.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.63. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.48
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.11. Worker CS 11: Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %. (PROC 9)

9.5.11.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.5.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.64. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.252
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.12. Worker CS 12: Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %. (PROC 14)

9.5.12.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0

	Method
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.5.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.65. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.206 mg/kg bw/day (TRA Workers)	RCR = 0.071
Combined routes, systemic, long-term		RCR = 0.081
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.13. Worker CS 13: Use as laboratory reagent; Covers percentage substance in the product up to 100 %. (PROC 15)

9.5.13.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is often handled in the presence of diisocyanates (e.g. MDI) and pentane for which handling under LEV (e.g. fume cupboard) is prerequisite to ensure safe use.*	TRA Workers 3.0

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.5.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.66. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.071
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.5.14. Worker CS 14: Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %. (PROC 21)

9.5.14.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	ECETOC TRA 3.1
• Physical form of the used product: Solid (medium dusty form) *Pure TCPP is a liquid. However, in this task TCPP is included into or onto a matrix. Exposure estimation is therefore based on solid state. Dust formation (if any) is assumed to be limited. Therefore, handling of a medium dusty solid during this task is taken as worst case.*	ECETOC TRA 3.1

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	ECETOC TRA 3.1
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ECETOC TRA 3.1
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA 3.1
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.* *Cutting of foam is done at <= 40°C.*	ECETOC TRA 3.1

9.5.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.67. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1.8 mg/m³ (ECETOC TRA 3.1)	RCR = 0.22
Inhalation, systemic, acute	7.2 mg/m³ (ECETOC TRA 3.1)	RCR = 0.319
Dermal, systemic, long term	0.17 mg/kg bw/day (ECETOC TRA 3.1)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.278
Combined routes, systemic, acute		RCR = 0.319

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6. Exposure scenario 6: Use at industrial sites - Foam granules and rebound PUR foam

Market sector: Foam granules and rebound PUR foam

Product category used: PC 32: Polymer Preparations and Compounds

Sector of use: SU 18: Manufacture of furniture; SU 19: Building and construction work

Environment contributing scenario(s):		
CS 1	Rebonding of flexible PUR foam	ERC 5
CS 2	Loose crumb (flexible) foam	ERC 5
CS 3	Adhesive pressing	ERC 5
Worker contributing scenario(s):		
CS 4	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 1
CS 5	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 2
CS 6	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %.	PROC 3
CS 7	Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %.	PROC 4
CS 8	Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %.	PROC 5
CS 9	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 10	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 11	Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %.	PROC 9
CS 12	Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %.	PROC 14
CS 13	Use as laboratory reagent; Covers percentage substance in the product up to 100 %.	PROC 15
CS 14	Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %.	PROC 21

Subsequent service life exposure scenario(s):

ES12: Service life (consumers) - Rigid foam, service life

ES13: Service life (consumers) - Flexible foam, service life

Further description of the use:

Rebonding of flexible PUR foam:

Bonded foam, or rebond, is a moulded PUR product made from pieces of shredded flexible PUR foam, held together with a binder. Foam pieces from various sources - production trim and post-consumer waste - can be suitable for rebonding, although in practice production

trim and cuttings are by far the most commonly processed. Rebonding is not relevant to moulded foams as the foam is pre-formed and thus not cut (ECB, 2008).

Granulators and flock-mills are normally used to shred the foam into pieces approximately one centimetre in diameter. There are other technologies available to handle large foam pieces by cutting them into very thin strips, which can then be reduced into smaller pieces. According to the TCPP EU RAR this type of process is deemed to be 'dust-free'. The authors of the TCPP EU RAR indicated that in the UK, modern equipment is of the 'turbine cutting' type, which produce particles of a controlled size and are designed to minimise production of dusts, which are in themselves a fire hazard. Some older types of equipment shred the foam by tearing, and produce more dust that is commonly removed by air filters and disposed of to landfill. However, as indicated by the authors of the TCPP EU RAR flame retardant (e.g. TCPP) containing foam is not processed by this method (ECB, 2008).

The rebonding technologies used vary according to the market requirements and the final use of the rebond articles. Rebonding of PUR foam can be carried out through batch or through continuous moulding. The foam blocks are further processed to fabricate parts and articles, resulting in trim which in turn can be reused in the process. Rebonding is also applied in the moulding-to-final-shape technology which allows processors to optimise material use and cost (ECB, 2008).

More details on rebonding of PUR foam can be found in Appendix A (Section 3) of the TCPP EU RAR.

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in rebonding of flexible foam in Europe [i.e. 714 tonnes TCPP equivalent to 10.5% of the TCPP used in flexible foam (e.g. 6800 tonnes)].

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production of flexible foam on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP used in production of flexible foam was 5230 tonnes.

In line with the TCPP EU RAR 10.5% (e.g. 549 tonnes) of the TCPP used in the year 2015 in the production of flexible foam considered relevant for rebonding of flexible foam.

Loose crumb (flexible) foam:

Shredded scrap foam is used directly for some applications. This is referred to as 'loose crumb' and is used in deep-buttoned soft-cushions for garden furniture and in some low-grade furniture applications. In Europe, the major use of loose crumb is reported to be in garden furniture (ECB, 2008).

In order to give a realistic worst case it is assumed by the authors of the TCPP EU RAR that 70% of the scrap foam remaining in the EU will be rebonded, whereas 30% will be recycled as loose crumb (ECB, 2008).

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in 'loose crumb' in Europe [i.e. 306 tonnes TCPP equivalent to 4.5% of the TCPP used in flexible foam (e.g. 6800 tonnes)].

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production of flexible foam on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume of TCPP used in production of flexible foam was 5230 tonnes.

In line with the TCPP EU RAR 4.5% (e.g. 235 tonnes) of the TCPP used in the year 2015 in the production of flexible foam considered relevant for 'loose crumb'.

Adhesive pressing:

Waste from the production of rigid PUR foam is used for adhesive pressing in the production of moulded boards for use in kitchen furniture and flooring. However, rigid PUR foam particles can also be used as oil binders e.g. by fire brigades for oil spill clean-up. After use, this is incinerated (ECB, 2008). According to the TCPP EU RAR 50% of scrap is used in adhesive pressing and 50% as oil binders.

For adhesive pressing PUR is granulated and blended with 5% to 10% polymeric methylene diphenyl diisocyanate (pMDI) and formed into boards/mouldings at temperatures up to 200°C and under pressure (20 to 200 bar). Products are finished by sawing and sanding or by applying additional facings (ECB, 2008). According to the TCPP EU RAR 1.5% of the rigid foam tonnage is recycled by adhesive pressing.

The TCPP EU RAR relied on the total tonnage TCPP used in the year 2000 in adhesive pressing in Europe [i.e. 400 tonnes TCPP equivalent to 1.5% of the TCPP used in rigid foam (e.g. 26650 tonnes)].

In the scope of REACH, the 'TCPP REACH consortium' consisting of four EU TCPP manufacturers provided data concerning production of rigid foam on a strictly confidential basis to the consortium management. Based on this information, in the year 2015 the total volume

of TCPP used in production of rigid foam was 29320 tonnes.

In line with the TCPP EU RAR 1.5% (e.g. 440 tonnes) of the TCPP used in the year 2015 in the production of rigid foam considered relevant for adhesive pressing.

9.6.1. Env CS 1: Rebonding of flexible PUR foam (ERC 5)

According to the TCPP EU RAR the granulation and rebonding processes are contained within equipment. Granulating machines are fitted with dust extraction equipment. The authors concluded that taking the same approach as for cutting of flexible PUR foam, it can be estimated that up to 0.1% of foam is lost as dust, and that 1% of this material is not collected by the extractor systems and could be released to the local air compartment. Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 4E-04% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.6.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 271.8 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.55*
• Daily use amount at site: <= 0.91 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 90.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.9*
Technical and organisational conditions and measures
• Extractor system in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing scrap flexible foam is only granuled at sites where an extractor system is in place with efficiency of 99% or better regarding removal of dust (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
• Application of the STP sludge on agricultural soil: Yes
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

9.6.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.68. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0%

Release	Release estimation method	Explanations
		Local release rate: 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4E-4% **Release factor after on site RMM:** 4E-4% **Local release rate:** 3.62E-3 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 0.1 %

50% incineration assumed in parallel to rigid foam [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 274.5 t/y

Fraction of substance becoming waste according to the TCPP EU RAR: 0.1%

Amount if substance in waste: 274.5 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 27.5 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 27.5 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 274.5 t/y

Fraction of substance becoming waste, TCPP EU RAR: 0.1%

Amount if substance in waste: 274.5 kg/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 439 g/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.001%

Amount of TCPP to water: 85.7 g/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 439 g/y released to soil is considered. The calculation of waste water effluent of 85.7 g/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.6.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.69. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.15E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.59E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 8.41E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 1.28E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.6.2. Env CS 2: Loose crumb (flexible) foam (ERC 5)

According to the TCPP EU RAR the granulation processes is contained within equipment. Granulating machines are fitted with dust extraction equipment. The authors concluded that taking the same approach as for cutting of flexible PUR foam, it can be estimated that up to 0.1% of foam is lost as dust, and that 1% of this material is not collected by the extractor systems and could be released to the local air compartment. Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 4E-04% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.6.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 116.5 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.55*
• Daily use amount at site: <= 0.39 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 300 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 90.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.9*
Technical and organisational conditions and measures
• Extractor system in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing scrap flexible foam is only granuled at sites where an extractor system is in place with efficiency of 99% or better regarding removal of dust (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
• Application of the STP sludge on agricultural soil: Yes
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

9.6.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.70. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4E-4% **Release factor after on site RMM:** 4E-4% **Local release rate:** 1.55E-3 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 0.1 %

50% incineration assumed in parallel to rigid foam [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 117.5 t/y

Fraction of substance becoming waste according to the TCPP EU RAR: 0.1%

Amount if substance in waste: 117.5 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 11.8 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 11.8 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 117.5 t/y

Fraction of substance becoming waste, TCPP EU RAR: 0.1%

Amount if substance in waste: 117.5 kg/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 188 g/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.0005%

Amount of TCPP to water: 36.7 g/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 188 g/y released to soil is considered. The calculation of waste water effluent of 36.7 g/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.6.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.71. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.11E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.57E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 3.68E-7 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 7.35E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.6.3. Env CS 3: Adhesive pressing (ERC 5)

In the absence of further information the TCPP EU RAR made use of read-across from the OECD Emission scenario document (ESD) on plastic additives, No. 3 (OECD, 2009) to conclude on the release rates from the process of adhesive pressing. Considering the worst case of an open system the ESD sets out release rates of 0.25% to air and 0.25% to wastewater. Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed release rates of 0.1% to air and 0.1% to wastewater (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.6.3.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Annual use amount at site: <= 26.4 tonnes/year *The fraction of the main local source (= annual use at a site) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(local) = 0.15*
• Daily use amount at site: <= 0.27 tonnes/day *As proposed in the TCPP EU RAR (ECB, 2008) 96 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 40.0 % *The fraction in the main region (= percentage of EU tonnage used at regional scale) is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008): F(region) = 0.4*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
• Application of the STP sludge on agricultural soil: Yes
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

9.6.3.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.72. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.1% **Release factor after on site RMM:** 0.1% **Local release rate:** 0.275 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.1% **Release factor after on site RMM:** 0.1% **Local release rate:** 0.275 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 1.5 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 220 t/y

Fraction of substance becoming waste according to the TCPP EU RAR: 1.5%

Amount if substance in waste: 3.3 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 330 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 330 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 220 t/y

Fraction of substance becoming waste, TCPP EU RAR: 1.5%

Amount if substance in waste: 3.3 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 5.28 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.013%

Amount of TCPP to water: 1.03 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 5.28 kg/y released to soil is considered. The calculation of waste water effluent of 1.03 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.6.3.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.73. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.013 mg/L	RCR = 0.042
Sediment (freshwater)	**Local PEC:** 0.48 mg/kg dw	RCR = 0.042
Marine water	**Local PEC:** 1.33E-3 mg/L	RCR = 0.042

Protection target	Exposure concentration	Risk quantification
Sediment (marine water)	**Local PEC:** 0.048 mg/kg dw	RCR = 0.042
Sewage Treatment Plant	**Local PEC:** 0.132 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 0.037 mg/kg dw	RCR = 0.108
Predator's prey (freshwater)	**Local PEC:** 0.026 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 2.59E-3 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 6.41E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 0.015 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 2.01E-5 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.47E-3 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.6.4. Worker CS 4: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 1)

9.6.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: No [Effectiveness Dermal: 0%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal*	TRA Workers 3.0

	Method
exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.6.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.74. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.017
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.5. Worker CS 5: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 2)

9.6.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.6.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.75. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.082 mg/kg bw/day (TRA Workers)	RCR = 0.028
Combined routes, systemic, long-term		RCR = 0.088
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.6. Worker CS 6: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers

percentage substance in the product up to 25 %. (PROC 3)

9.6.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.6.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.76. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.014

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, long-term		RCR = 0.074
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.7. Worker CS 7: Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %. (PROC 4)

9.6.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to*	TRA Workers 3.0

	Method
35°C.	

9.6.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.77. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.412 mg/kg bw/day (TRA Workers)	RCR = 0.141
Combined routes, systemic, long-term		RCR = 0.151
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.8. Worker CS 8: Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %. (PROC 5)

9.6.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	

	Method
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.6.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.78. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.293
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.9. Worker CS 9: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.6.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0

	Method
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.6.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.79. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.488
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.10. Worker CS 10: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.6.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	

	Method
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.6.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.80. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.48
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.11. Worker CS 11: Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %. (PROC 9)

9.6.11.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0

	Method
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.6.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.81. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.252
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.12. Worker CS 12: Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %. (PROC 14)

9.6.12.1. Conditions of use

	Method

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) and, often, pentane for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	TRA Workers 3.0

9.6.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.82. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.206 mg/kg bw/day (TRA Workers)	RCR = 0.071
Combined routes, systemic, long-term		RCR = 0.081
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.13. Worker CS 13: Use as laboratory reagent; Covers percentage substance in the product up to 100 %. (PROC 15)

9.6.13.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is often handled in the presence of diisocyanates (e.g. MDI) and pentane for which handling under LEV (e.g. fume cupboard) is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.6.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.83. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.071

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.6.14. Worker CS 14: Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %. (PROC 21)

9.6.14.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	ECETOC TRA 3.1
• Physical form of the used product: Solid (very dusty form) *Pure TCPP is a liquid. However, in this task TCPP is included into or onto a matrix. Exposure estimation is therefore based on solid state. Dust formation is likely. Therefore, handling of a very dusty solid during this task is taken as worst case.*	ECETOC TRA 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	ECETOC TRA 3.1
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
• Local exhaust ventilation: Yes [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is required to ensure safe use.*	ECETOC TRA 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ECETOC TRA 3.1
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA 3.1
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.* *Cutting of foam is done at <= 40°C.*	ECETOC TRA 3.1

9.6.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.84. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.6 mg/m³ (ECETOC TRA 3.1)	RCR = 0.073
Inhalation, systemic, acute	2.4 mg/m³ (ECETOC TRA 3.1)	RCR = 0.106
Dermal, systemic, long term	0.17 mg/kg bw/day (ECETOC TRA 3.1)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.132
Combined routes, systemic, acute		RCR = 0.106

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.7. Exposure scenario 7: Widespread use by professional workers - One-component PUR foams, professional application (foaming)

Market sector: One-component PUR foams

Product category used: PC 1: Adhesives, Sealants; PC 32: Polymer Preparations and Compounds

Sector of use: SU 19: Building and construction work

Environment contributing scenario(s):		
CS 1	One-component PUR foams, professional application (foaming), indoor	ERC 8c
CS 2	One-component PUR foams, professional application (foaming), outdoor	ERC 8f
Worker contributing scenario(s):		
CS 3	Non-industrial spraying; Roller application or brushing; Covers percentage substance in the product up to 25 %.	PROC 11, PROC 10
CS 4	Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %.	PROC 21

Subsequent service life exposure scenario(s):

ES12: Service life (consumers) - Rigid foam, service life

9.7.1. Env CS 1: One-component PUR foams, professional application (foaming), indoor (ERC 8c)

In the TCPP EU RAR it is concluded that like for spray foams based on an uncovered foam (at the time of spraying) the loss rate from foaming in situ can be estimated as 0.00066% per day (i.e. 0.24% over the year). Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 9.6E-02% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.7.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.0032 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Technical and organisational conditions and measures
• Indoor/outdoor use: Indoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk) *Low risk assumed for waste life stage. Waste disposal according to national/local legislation is sufficient.*

9.7.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.85. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day

Release	Release estimation method	Explanations
		Explanation: According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 1156 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 57.8 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 5.78 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 5.78 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 4622.4 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 231 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 370 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.90%

Amount of TCPP to water: 72.2 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 370 kg/y released to soil is considered. The calculation of waste water effluent of 72.2 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.7.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.86. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.7.2. Env CS 2: One-component PUR foams, professional application (foaming), outdoor (ERC 8f)

In the TCPP EU RAR it is concluded that like for spray foams based on an uncovered foam (at the time of spraying) the loss rate from foaming in situ can be estimated as 0.00066% per day (i.e. 0.24% over the year). Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 9.6E-02% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.7.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.0032 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Technical and organisational conditions and measures
• Indoor/outdoor use: Outdoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk) *Low risk assumed for waste life stage. Waste disposal according to national/local legislation is sufficient.*

9.7.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.87. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment

Release	Release estimation method	Explanations
		Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 1156 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 57.8 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 5.78 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 5.78 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 4622.4 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 231 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 370 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.90%

Amount of TCPP to water: 72.2 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 370 kg/y released to soil is considered. The calculation of waste water effluent of 72.2 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.7.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.88. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.7.3. Worker CS 3: Non-industrial spraying; Roller application or brushing; Covers percentage substance in the product up to 25 %. (PROC 11, PROC 10)

9.7.3.1. Conditions of use

	Method
Product (Article) characteristics	
• [ConsExpo Worker] Weight fraction of the compound of interest: 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly in the spray nozzle by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Vapour pressure (at application temperature): < 0.0037 Pa	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Average molecular weight of the matrix (product minus the compound of interest): 3000 g/mol	ConsExpo 4.1 (adapted for worker)
Amount used (or contained in articles), frequency and duration of use/exposure	
• [ConsExpo Worker] Use frequency: 1.0 times/day	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Exposure duration (time): 480.0 min	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Application duration: 120.0 min	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Applied amount: 3300 g *Worst case it is assumed that a worker is using 4 cans (each containing 825 g one-component foam) in a 8 hour shift (4 x 825 g = 3300 g).*	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Mass transfer rate: 0.19 m/min	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Mass transfer rate - Approximating model: Thibodeux's method	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Dermal exposure model / Applied amount: 1.0 g	ConsExpo 4.1 (adapted for worker)
Technical and organisational conditions and measures	
• [ConsExpo Worker] Inhalation exposure model / Room volume: 57.5 m3	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Ventilation rate: 0.5 air changes/hour	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model / Release area: 8.0 m2	ConsExpo 4.1 (adapted for worker)

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• [ConsExpo Worker] Dermal Protection (REFINEMENT): yes (minimum efficiency dermal: 90%) *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ConsExpo 4.1 (adapted for worker)
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor	
• [ConsExpo Worker] Application temperature: 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.*	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Body weight: 65.0 kg	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Dermal exposure model / Exposed area: 1900 cm2	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Details Assessment tool: ConsExpo v4.1 for inhalation and dermal exposure	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Deviation from default scenario?: yes	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Inhalation exposure model: Exposure to vapour - Evaporation	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Dermal exposure model: Direct dermal contact with product - Instant application	ConsExpo 4.1 (adapted for worker)
• [ConsExpo Worker] Default scenario: DO IT YOURSELF PRODUCTS >> Miscellaneous do it yourself products >> Isolation foam >> Application	ConsExpo 4.1 (adapted for worker)

9.7.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.89. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.222 mg/m³ (ConsExpo 4.1 (adapted for worker))	RCR = 0.027
Inhalation, systemic, acute	0.888 mg/m³ (ConsExpo 4.1 (adapted for worker))	RCR = 0.039
Dermal, systemic, long term	0.385 mg/kg bw/day (ConsExpo 4.1 (adapted for worker))	RCR = 0.132
Combined routes, systemic, long-term		RCR = 0.159
Combined routes, systemic, acute		RCR = 0.039

9.7.4. Worker CS 4: Low energy manipulation and handling of substances bound in/on materials and/or articles; Covers percentage substance in the product up to 25 %. (PROC 21)

9.7.4.1. Conditions of use

	Method
Product (Article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) for this step can be regarded as reasonable worst case.*	ECETOC TRA 3.1
• Physical form of the used product: Solid (medium dusty form) *Pure TCPP is a liquid. However, in this task TCPP is included into or onto a matrix. Exposure estimation is therefore based on solid state. Dust formation (if any) is assumed to be limited. Therefore, handling of a medium dusty solid during this task is taken as worst case.*	ECETOC TRA 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	ECETOC TRA 3.1
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	ECETOC TRA 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	ECETOC TRA 3.1
• Respiratory protection: No [Effectiveness Inhalation: 0%]	ECETOC TRA 3.1
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor	ECETOC TRA 3.1
• Operating temperature: <= 40.0 °C *High temperatures (typically in the range 120-140°C) are only reached when the foam cells are already closed and thus any TCPP will be kept within the foam. In the liquid phase, before the cells are formed, the temperature is up to 35°C.* *Cutting of foam is done at <= 40°C.*	ECETOC TRA 3.1

9.7.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.90. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3 mg/m³ (ECETOC TRA 3.1)	RCR = 0.366
Inhalation, systemic, acute	12 mg/m³ (ECETOC TRA 3.1)	RCR = 0.531
Dermal, systemic, long term	0.17 mg/kg bw/day (ECETOC TRA 3.1)	RCR = 0.058
Combined routes, systemic, long-term		RCR = 0.424
Combined routes, systemic, acute		RCR = 0.531

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.8. Exposure scenario 8: Consumer use - One-component PUR foams, consumer application (foaming)

Market sector: One-component PUR foams

Environment contributing scenario(s):		
CS 1	One-component PUR foams, consumer application (foaming), indoor	ERC 8c
CS 2	One-component PUR foams, consumer application (foaming), outdoor	ERC 8f
Consumer contributing scenario(s):		
CS 3	Adhesives, sealants; Covers percentage substance in the product up to 25 %.	PC 1
CS 4	Polymer preparations and compounds; Covers percentage substance in the product up to 25 %.	PC 32

Subsequent service life exposure scenario(s):

ES12: Service life (consumers) - Rigid foam, service life

9.8.1. Env CS 1: One-component PUR foams, consumer application (foaming), indoor (ERC 8c)

In the TCPP EU RAR it is concluded that like for spray foams based on an uncovered foam (at the time of spraying) the loss rate from foaming in situ can be estimated as 0.00066% per day (i.e. 0.24% over the year). Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 9.6E-02% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.8.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.0017 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk) *Low risk assumed for waste life stage. Waste disposal according to national/local legislation is sufficient.*
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.8.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.91. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment

Release	Release estimation method	Explanations
		Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 620.4 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 31.0 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 3.10 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 3.10 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 2481.6 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 124 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 198 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.49%

Amount of TCPP to water: 38.8 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 198 kg/y released to soil is considered. The calculation of waste water effluent of 38.8 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.8.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.92. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.8.2. Env CS 2: One-component PUR foams, consumer application (foaming), outdoor (ERC 8f)

In the TCPP EU RAR it is concluded that like for spray foams based on an uncovered foam (at the time of spraying) the loss rate from foaming in situ can be estimated as 0.00066% per day (i.e. 0.24% over the year). Accounting for the finding that for TCPP only 40% of the substance present is available for release, the authors of the TCPP EU RAR proposed a release rate of 9.6E-02% to air (ECB, 2008). For further details please refer to Appendix B of the TCPP EU RAR.

9.8.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.0017 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk) *Low risk assumed for waste life stage. Waste disposal according to national/local legislation is sufficient.*
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.8.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.93. Local releases to the environment

Release	**Release estimation method**	Explanations
Water	Estimated release factor (TCPP EU RAR)	Release factor before on site RMM: 0% Release factor after on site RMM: 0% Local release rate: 0 kg/day Explanation: According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 620.4 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 31.0 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 3.10 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 3.10 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 2481.6 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 124 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 198 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.49%

Amount of TCPP to water: 38.8 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 198 kg/y released to soil is considered. The calculation of waste water effluent of 38.8 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.8.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.94. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.8.3. Cons CS 3:Adhesives, sealants; Covers percentage substance in the product up to 25 %. (PC 1)

9.8.3.1. Conditions of use

	Method
Product (article) characteristics	
• [ConsExpo] Weight fraction of the compound of interest: 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly in the spray nozzle by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	ConsExpo 4.1
• [ConsExpo] Vapour pressure (at application temperature): < 0.0037 Pa	ConsExpo 4.1

	Method
• [ConsExpo] Inhalation exposure model / Average molecular weight of the matrix (product minus the compound of interest): 3000 g/mol	ConsExpo 4.1
• Exposure via oral route: Oral exposure is considered to be not relevant	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• [ConsExpo] Use frequency: 0.00055 times/day *The exposure frequency is assumed to be once every five years (= 0.2 times/year = 0.00055 times/day).*	ConsExpo 4.1
• [ConsExpo] Exposure duration (time): 480.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Application duration: 30.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Applied amount: 825.0 g	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Mass transfer rate: 0.19 m/min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Mass transfer rate - Approximating model: Thibodeux's method	ConsExpo 4.1
• [ConsExpo] Dermal exposure model / Applied amount: 0.25 g	ConsExpo 4.1
Information and behavioral advice for consumers	
• [ConsExpo] Inhalation exposure model / Ventilation rate: 0.5 air changes/hour	ConsExpo 4.1
Other conditions affecting consumers exposure	
• [ConsExpo] Application temperature: 40.0 °C	ConsExpo 4.1
• [ConsExpo] Body weight: 65.0 kg	ConsExpo 4.1
• [ConsExpo] Dermal exposure model / Exposed area: 1900 cm2	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Release area: 2.0 m2	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Room volume: 57.5 m3	ConsExpo 4.1
• [ConsExpo] Default scenario: DO IT YOURSELF PRODUCTS >> Miscellaneous do it yourself products >> Isolation foam >> Application	ConsExpo 4.1
• [ConsExpo] Deviation from default scenario?: yes	ConsExpo 4.1
• [ConsExpo] Details Assessment tool: ConsExpo v4.1 for inhalation and dermal exposure	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model: Exposure to vapour - Evaporation	ConsExpo 4.1
• [ConsExpo] Dermal exposure model: Direct dermal contact with product - Instant application	ConsExpo 4.1

9.8.3.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.95. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3.42E-7 mg/m³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, systemic, acute	0.03 mg/m³ (ConsExpo 4.1)	RCR < 0.01
Dermal, systemic, long term	5.27E-4 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Oral, systemic, long term	0 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, acute		RCR < 0.01

9.8.4. Cons CS 4: Polymer preparations and compounds; Covers percentage substance in the product up to 25 %. (PC 32)

9.8.4.1. Conditions of use

	Method
Product (article) characteristics	
• [ConsExpo] Weight fraction of the compound of interest: 25.0 % *The TCPP content depends on the foam grade and varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly in the spray nozzle by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	ConsExpo 4.1
• [ConsExpo] Vapour pressure (at application temperature): < 0.0037 Pa	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Average molecular weight of the matrix (product minus the compound of interest): 3000 g/mol	ConsExpo 4.1
• Exposure via oral route: Oral exposure is considered to be not relevant	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• [ConsExpo] Use frequency: 0.00055 times/day *The exposure frequency is assumed to be once every five years (= 0.2 times/year = 0.00055 times/day).*	ConsExpo 4.1
• [ConsExpo] Exposure duration (time): 480.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Application duration: 30.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Applied amount: 825.0 g	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Mass transfer rate: 0.19 m/min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Mass transfer rate - Approximating model: Thibodeux's method	ConsExpo 4.1
• [ConsExpo] Dermal exposure model / Applied amount: 0.25 g	ConsExpo 4.1
Information and behavioral advice for consumers	
• [ConsExpo] Inhalation exposure model / Ventilation rate: 0.5 air changes/hour	ConsExpo 4.1
Other conditions affecting consumers exposure	
• [ConsExpo] Application temperature: 40.0 °C	ConsExpo 4.1
• [ConsExpo] Body weight: 65.0 kg	ConsExpo 4.1
• [ConsExpo] Dermal exposure model / Exposed area: 1900 cm2	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Release area: 2.0 m2	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Room volume: 57.5 m3	ConsExpo 4.1
• [ConsExpo] Default scenario: DO IT YOURSELF PRODUCTS >> Miscellaneous do it yourself products >> Isolation foam >> Application	ConsExpo 4.1
• [ConsExpo] Deviation from default scenario?: yes	ConsExpo 4.1
• [ConsExpo] Details Assessment tool: ConsExpo v4.1 for inhalation and dermal exposure	ConsExpo 4.1

	Method
• [ConsExpo] Inhalation exposure model: Exposure to vapour - Evaporation	ConsExpo 4.1
• [ConsExpo] Dermal exposure model: Direct dermal contact with product - Instant application	ConsExpo 4.1

9.8.4.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.96. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3.42E-7 mg/m³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, systemic, acute	0.03 mg/m³ (ConsExpo 4.1)	RCR < 0.01
Dermal, systemic, long term	5.27E-4 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Oral, systemic, long term	0 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01
Combined routes, systemic, acute		RCR < 0.01

9.9. Exposure scenario 9: Use at industrial sites - CASE, industrial application

Market sector: Coatings, adhesives, sealants and elastomers ('CASE')

Product category used: PC 1: Adhesives, Sealants; PC 9a: Coatings and Paints, Thinners, paint removers; PC 32: Polymer Preparations and Compounds

Sector of use: SU 12: Manufacture of plastics products, including compounding and conversion

Environment contributing scenario(s):		
CS 1	CASE, industrial application	ERC 5
Worker contributing scenario(s):		
CS 2	Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 1
CS 3	Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %.	PROC 2
CS 4	Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %.	PROC 3
CS 5	Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %.	PROC 4
CS 6	Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %.	PROC 5
CS 7	Industrial spraying; Covers percentage substance in the product up to 25 %.	PROC 7
CS 8	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 9	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 10	Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %.	PROC 9
CS 11	Calendering operations; Covers percentage substance in the product up to 25 %.	PROC 6
CS 12	Roller application or brushing; Covers percentage substance in the product up to 25 %.	PROC 10
CS 13	Treatment of articles by dipping and pouring; Covers percentage substance in the product up to 25 %.	PROC 13
CS 14	Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %.	PROC 14
CS 15	Use as laboratory reagent; Covers percentage substance in the product up to 100 %.	PROC 15

9.9.1. Env CS 1: CASE, industrial application (ERC 5)

9.9.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)

• Annual use amount at site: <= 179.0 tonnes/year *Worst case it is assumed that the complete tonnage of TCPP used in coatings, adhesives, sealants and elastomers ('CASE')is used at one industrial site. F(local) = 1*
• Daily use amount at site: <= 8.9 tonnes/day *As proposed in the ECHA guidance R.16: Environmental Exposure Estimation (version 3.0, February 2016) 20 release days are used for calculation.*
• Percentage of EU tonnage used at regional scale: = 100.0 % *Worst case it is assumed that the complete tonnage of TCPP used in coatings, adhesives, sealants and elastomers ('CASE')is used in one region. F(region) = 1*
Technical and organisational conditions and measures
• Fume elimination equipment in place?: yes *In line with the TCPP EU RAR it is assumed that TCPP containing foam is only produced at sites where fume elimination equipment is in place with efficiency of 90% or better regarding volatile emissions (EC, 2008).*
Conditions and measures related to biological sewage treatment plant
• Biological STP: Site specific [Effectiveness Water: 3.885%]
• Application of the STP sludge on agricultural soil: No
• Discharge rate of STP: >= 2000 m3/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 18000 m3/day

Fate (release percentage) in the biological sewage treatment plant

The biological STP is site specific and the releases to the various compartments have been set by the assessor They are distributed in the following way:

Release to water	96.12%
Release to air	3.83E-4%
Release to sludge	3.884%
Release degraded	0%

Explanation: Default EUSES settings

9.9.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.97. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.01% **Release factor after on site RMM:** 0.01% **Local release rate:** 0.895 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk

Release	Release estimation method	Explanations
		Assessment Report (RAR) for TCPP (ECB, 2008). The industrial use of TCPP in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from rigid foam production at small sites. Please note that for small sites the TCPP EU RAR included an additional release of 0.01% to wastewater from handling of raw materials.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 4.8E-6% **Release factor after on site RMM:** 4.8E-6% **Local release rate:** 4.3E-4 kg/day **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). The industrial use of TCPP in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from rigid foam production at small sites.
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to (industrial) soil is not expected. The industrial use of TCPP in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from rigid foam production at small sites.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 35.8 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 1.79 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 179 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 179 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 143.2 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 7.16 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 11.5 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.03%

Amount of TCPP to water: 2.24 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 11.5 kg/y released to soil is considered. The calculation of waste water effluent of 2.24 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.9.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.98. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 0.043 mg/L	RCR = 0.135
Sediment (freshwater)	**Local PEC:** 1.553 mg/kg dw	RCR = 0.135
Marine water	**Local PEC:** 4.31E-3 mg/L	RCR = 0.135
Sediment (marine water)	**Local PEC:** 0.155 mg/kg dw	RCR = 0.135
Sewage Treatment Plant	**Local PEC:** 0.43 mg/L	RCR = 0.023
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 0.018 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.8E-3 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 4.85E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.92E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 1.55E-4 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.9.2. Worker CS 2: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 1)

9.9.2.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed process without likelihood of exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0

	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: No [Effectiveness Dermal: 0%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.99. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.02 mg/kg bw/day (TRA Workers)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.017
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.3. Worker CS 3: Chemical production or refinery in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions; Covers percentage substance in the product up to 25 %. (PROC 2)

9.9.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0

	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed continuous process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.100. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.082 mg/kg bw/day (TRA Workers)	RCR = 0.028
Combined routes, systemic, long-term		RCR = 0.088
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.4. Worker CS 4: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition; Covers percentage substance in the product up to 25 %. (PROC 3)

9.9.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Closed batch process with occasional controlled exposure	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.101. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.041 mg/kg bw/day (TRA Workers)	RCR = 0.014
Combined routes, systemic, long-term		RCR = 0.074
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.5. Worker CS 5: Chemical production where opportunity for exposure arises; Covers percentage substance in the product up to 25 %. (PROC 4)

9.9.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.102. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.412 mg/kg bw/day (TRA Workers)	RCR = 0.141
Combined routes, systemic, long-term		RCR = 0.151

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.6. Worker CS 6: Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %. (PROC 5)

9.9.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.103. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.293
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.7. Worker CS 7: Calendering operations; Covers percentage substance in the product up to 25 %. (PROC 6)

9.9.7.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0

	Method
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.104. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.646 mg/kg bw/day (TRA Workers)	RCR = 0.566
Combined routes, systemic, long-term		RCR = 0.576
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 9.92E-4 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.8. Worker CS 8: Industrial spraying; Covers percentage substance in the product up to 25 %. (PROC 7)

9.9.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is required to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with specific activity training) and (other) appropriate dermal protection [Effectiveness Dermal: 95%]	TRA Workers 3.0

	Method
Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure efficiency of the applied dermal protection specific activity training is required.	
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *When TCPP containing aerosols can be formed operators are advised to wear self-sustained breathing apparatus or air-supplied masks in order to reduce inhalation exposure significantly.*	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.105. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	2.047 mg/m³ (TRA Workers)	RCR = 0.25
Inhalation, systemic, acute	8.189 mg/m³ (TRA Workers)	RCR = 0.362
Dermal, systemic, long term	1.286 mg/kg bw/day (TRA Workers)	RCR = 0.442
Combined routes, systemic, long-term		RCR = 0.692
Combined routes, systemic, acute		RCR = 0.362

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.9. Worker CS 9: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.9.9.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area*	TRA Workers 3.0

	Method
where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.106. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.488
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.10. Worker CS 10: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.9.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0

	Method
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 95%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.107. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.068 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.48
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.11. Worker CS 11: Transfer of substance or mixture into small containers (dedicated filling line, including weighing); Covers percentage substance in the product up to 100 %. (PROC 9)

9.9.10.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	

	Method
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.108. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.137 mg/m³ (TRA Workers)	RCR = 0.017
Inhalation, systemic, acute	0.137 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.686 mg/kg bw/day (TRA Workers)	RCR = 0.236
Combined routes, systemic, long-term		RCR = 0.252
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.12. Worker CS 12: Roller application or brushing; Covers percentage substance in the product up to 25 %. (PROC 10)

9.9.12.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as*	TRA Workers 3.0

	Method
reasonable worst case.	
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.109. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	1.646 mg/kg bw/day (TRA Workers)	RCR = 0.566
Combined routes, systemic, long-term		RCR = 0.576
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.13. Worker CS 13: Treatment of articles by dipping and pouring; Covers percentage substance in the product up to 25 %. (PROC 13)

9.9.13.1. Conditions of use

	Method

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.110. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.293
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of

TCPP exposure to workers is adequately controlled.

9.9.14. Worker CS 14: Tabletting, compression, extrusion, pelettisation, granulation; Covers percentage substance in the product up to 25 %. (PROC 14)

9.9.14.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 90%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, LEV is available in the production area where TCPP is handled in the presence of diisocyanates (e.g. MDI) for which LEV is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.111. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Inhalation, systemic, acute	0.082 mg/m³ (TRA Workers)	RCR < 0.01
Dermal, systemic, long term	0.206 mg/kg bw/day (TRA Workers)	RCR = 0.071
Combined routes, systemic, long-term		RCR = 0.081
Combined routes, systemic, acute		RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.9.15. Worker CS 15: Use as laboratory reagent; Covers percentage substance in the product up to 100 %. (PROC 15)

9.9.15.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is often handled in the presence of diisocyanates (e.g. MDI) and pentane for which handling under LEV (e.g. fume cupboard) is prerequisite to ensure safe use.*	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure. In addition TCPP is handled in the presence of diisocyanates (e.g. MDI) for which dermal protection is prerequisite to ensure safe use.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.9.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.112. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers)	RCR = 0.059

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers)	RCR = 0.022
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.071
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10. Exposure scenario 10: Widespread use by professional workers - CASE, professional application

Market sector: Coatings, adhesives, sealants and elastomers ('CASE')

Product category used: PC 1: Adhesives, Sealants; PC 9a: Coatings and Paints, Thinners, paint removers; PC 32: Polymer Preparations and Compounds

Sector of use: SU 12: Manufacture of plastics products, including compounding and conversion

Environment contributing scenario(s):		
CS 1	CASE, professional application, indoor	ERC 8c
CS 2	CASE, professional application, outdoor	ERC 8f
Worker contributing scenario(s):		
CS 3	Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %.	PROC 5
CS 4	Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %.	PROC 8a
CS 5	Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %.	PROC 8b
CS 6	Roller application or brushing; Covers percentage substance in the product up to 25 %.	PROC 10
CS 7	Non-industrial spraying; Covers percentage substance in the product up to 25 %.	PROC 11
CS 8	Treatment of articles by dipping and pouring; Covers percentage substance in the product up to 25 %.	PROC 13

9.10.1. Env CS 1: CASE, professional application, indoor (ERC 8c)

9.10.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.000043 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Technical and organisational conditions and measures
• Indoor/outdoor use: Indoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*

9.10.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.113. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP	**Release factor before on site RMM:** 0%

Release	Release estimation method	Explanations
	EU RAR)	**Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected. The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected. The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 15.8 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 790 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 79 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 79 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 63.2 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 3.16 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 5.06 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.01%

Amount of TCPP to water: 0.99 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 5.06 kg/y released to soil is considered. The calculation of waste water effluent of 0.99 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.10.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.114. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.10.2. Env CS 2: CASE, professional application, outdoor (ERC 8f)

9.10.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.000043 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Technical and organisational conditions and measures
• Indoor/outdoor use: Outdoor use
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*

9.10.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.115. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day

Release	Release estimation method	Explanations
		Explanation: According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected. The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008). The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected. The use of TCPP by professional worker in coatings, adhesives, sealants and elastomers ('CASE') is not explicitly defined in the TCPP EU RAR. However, it is assumed that releases to the environment are similar to those from one-component foaming.

Releases to waste

Release factor to external waste: 5 %

20% incineration of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 15.8 t/y

Default fraction of substance becoming waste*): 5%

Amount if substance in waste: 790 kg/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 79 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 79 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (version 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 63.2 t/y

Fraction of substance becoming waste*): 5%

Amount if substance in waste: 3.16 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 5.06 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.01%

Amount of TCPP to water: 0.99 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 5.06 kg/y released to soil is considered. The calculation of waste water effluent of 0.99 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.10.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.116. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.10.3. Worker CS 3: Mixing or blending in batch processes; Covers percentage substance in the product up to 25 %. (PROC 5)

9.10.3.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0

	Method
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.10.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.117. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.022
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers 3.0)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.342
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10.4. Worker CS 4: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities; Covers percentage substance in the product up to 100 %. (PROC 8a)

9.10.4.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%]	TRA Workers 3.0

	Method
Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.	
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.10.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.118. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers 3.0)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10.5. Worker CS 5: Transfer of substance or mixture (charging/discharging) at dedicated facilities; Covers percentage substance in the product up to 100 %. (PROC 8b)

9.10.5.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0 TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0 TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0 TRA Workers 3.0

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0 TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0 TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0 TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0 TRA Workers 3.0

9.10.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.119. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.022
Dermal, systemic, long term	1.371 mg/kg bw/day (TRA Workers 3.0)	RCR = 0.471
Combined routes, systemic, long-term		RCR = 0.53
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10.6. Worker CS 6: Roller application or brushing; Covers percentage substance in the product up to 25 %. (PROC 10)

9.10.6.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0

	Method
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.10.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.120. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.022
Dermal, systemic, long term	1.646 mg/kg bw/day (TRA Workers 3.0)	RCR = 0.566
Combined routes, systemic, long-term		RCR = 0.625
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.
The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10.7. Worker CS 7: Non-industrial spraying; Covers percentage substance in the product up to 25 %. (PROC 11)

9.10.7.1. Conditions of use

	Method
Product (Article) characteristics	

	Method
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0 (modified) ART 1.5
• Physical form of the used product: Liquid	TRA Workers 3.0 (modified) ART 1.5
• [ART] Viscosity of the substance/preparation: Liquids with medium viscosity (like oil)	ART 1.5
• [ART] Vapour pressure at process temperature: < 0.0037 Pa	ART 1.5
• [ART] Activity coefficient: = 1.0	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0 (modified) ART 1.5
Technical and organisational conditions and measures	
• [ART] Primary emission source proximity: Primary emission source located in the breathing zone of the worker (Near field source)	ART 1.5
• [ART] Housekeeping practices: General good housekeeping practices in place	ART 1.5
• [ART] Dispersion - General ventilation: No restriction on general ventilation characteristics	ART 1.5
• [ART] Activity class: Spray application of liquids / Surface spraying of liquids	ART 1.5
• [ART] Situation: Moderate application rate (0.3 - 3 l/minute)	ART 1.5
• [ART] Spray technique: Spraying with no or low compressed air use	ART 1.5
• [ART] Spray direction: Only horizontal or downward spraying	ART 1.5
• [ART] Primary localized controls: No localized controls [Effectiveness Inhalation: 0%]	ART 1.5
• [ART] Secondary emission source: No secondary emission sources present in the workroom in addition to the source in the breathing zone of the worker	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (Respirator with APF of 20) [Effectiveness Inhalation: 95%] *When TCPP containing aerosols can be formed operators are advised to wear a half mask equipped with a type A filter class 1 or 2A filter in combination with particulate filter P2 or P3 in order to reduce inhalation exposure significantly.*	ART 1.5
• Dermal protection (refinement): Yes (Chemically resistant gloves conforming to EN374 with intensive management supervision controls) and (other) appropriate dermal protection [Effectiveness Dermal: 98%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly. To ensure high efficiency of the applied dermal protection intensive activity training and management supervision is required. During this application a minimum dermal efficiency of 98% is achievable as this application is semi-industrial.*	TRA Workers 3.0 (modified)
Other conditions affecting workers exposure	

	Method
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case outdoor use close to buildings is assumed.*	ART 1.5
• Operating temperature: <= 40.0 °C	ART 1.5
• [ART] Details Assessment tool: Advanced REACH Tool v1.5 (ART) for inhalation exposure	ART 1.5
• [ART] Deviation from Advanced REACH Tool: yes, the use of respiratory protective equipment (RPE) is assumed	ART 1.5
• [ART] Details Exposure predictions: The predicted values for inhalation exposure refer to the 90th percentile full-shift exposure	ART 1.5

9.10.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.121. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.295 mg/m³ (ART 1.5)	RCR = 0.036
Inhalation, systemic, acute	0.59 mg/m³ (ART 1.5)	RCR = 0.026
Dermal, systemic, long term	1.286 mg/kg bw/day (TRA Workers 3.0 (modified))	RCR = 0.442
Combined routes, systemic, long-term		RCR = 0.478
Combined routes, systemic, acute		RCR = 0.026

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.10.8. Worker CS 8: Treatment of articles by dipping and pouring; Covers percentage substance in the product up to 25 %. (PROC 13)

9.10.8.1. Conditions of use

	Method
Product (Article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 25.0 % *The TCPP content varies between 0 and 50% (w/w) in the corresponding polyol-component. During the process this amount is diluted directly by the diisocyanate-component (typical ratio polyol/diisocyanate component approx. 50:50). Therefore, it can be assumed that the maximum TCPP concentration for this step is 25% (w/w) and can be regarded as reasonable worst case.*	TRA Workers 3.0
• Physical form of the used product: Liquid	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0

	Method
• Local exhaust ventilation: No [Effectiveness Inhalation: 0%, Dermal: 0%]	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Operators are advised to wear overalls, suitable gloves and boots in order to reduce dermal exposure significantly.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Place of use: Indoor and outdoor *Professional CASE application is performed indoors and outdoors. As a reasonable worst-case indoor use with basic general ventilation (at least 1-3 air changes per hour) is assumed.*	TRA Workers 3.0
• Operating temperature: <= 40.0 °C	TRA Workers 3.0

9.10.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.122. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.059
Inhalation, systemic, acute	0.486 mg/m³ (TRA Workers 3.0)	RCR = 0.022
Dermal, systemic, long term	0.823 mg/kg bw/day (TRA Workers 3.0)	RCR = 0.283
Combined routes, systemic, long-term		RCR = 0.342
Combined routes, systemic, acute		RCR = 0.022

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.11. Exposure scenario 11:Widespread use by professional workers - Laboratory use, professional

Environment contributing scenario(s):		
CS 1	Wide dispersive indoor use resulting in inclusion into or onto a matrix	ERC 8c
Worker contributing scenario(s):		
CS 2	Use as laboratory reagent; Covers percentage substance in the product up to 100 %.	PROC 15

9.11.1.Env CS 1:Wide dispersive indoor use resulting in inclusion into or onto a matrix (ERC 8c)

9.11.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.00000055 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 3.887%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: Other *It is assumed that any waste for disposal is treated as hazardous waste and will be treated accordingly.*

9.11.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.123. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	**Release factor before on site RMM:** 30% **Release factor after on site RMM:** 30% **Local release rate:** 1.65E-4 kg/day
Air	ERC	**Release factor before on site RMM:** 15% **Release factor after on site RMM:** 15%
Non agricultural soil	ERC	**Release factor after on site RMM:** 0%

Releases to waste

Release factor to external waste: 100 %

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid and liquid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 1 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 1 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 100 g/y

Default release factor to water*): 0.0001

Amount of substance to water*): 100 g/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

9.11.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.124. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.21E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.37E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.19E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 4.27E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 7.93E-5 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.29E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.64E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.61E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.56E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.64E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.37E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.11.2. Worker CS 2: Use as laboratory reagent; Covers percentage substance in the product up to 100 %. (PROC 15)

9.11.2.1. Conditions of use

	Method
Product (Article) characteristics	

	Method
• Physical form of the used product: Liquid	TRA Workers 3.0
• Percentage (w/w) of substance in mixture/article: <= 100.0 %	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8.0 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Local exhaust ventilation: Yes (TRA effectiveness) [Effectiveness Inhalation: 80%, Dermal: 0%] *Local exhaust ventilation (LEV) is not required to ensure safe use. However, in a laboratory TCPP is often handled under LEV (e.g. fume cupboard).*	TRA Workers 3.0
• General ventilation: Basic general ventilation (1-3 air changes per hour) [Effectiveness Inhalation: 0%]	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Dermal protection: Yes (Chemically resistant gloves conforming to EN374 with basic employee training) and (other) appropriate dermal protection [Effectiveness Dermal: 90%] *Specific dermal protection is not required to ensure safe use. However, as part of the risk reduction strategy implemented by industry operators are advised to wear lab coats and suitable gloves in order to reduce dermal exposure.*	TRA Workers 3.0
• Respiratory protection: No [Effectiveness Inhalation: 0%]	TRA Workers 3.0
Other conditions affecting workers exposure	
• Operating temperature: <= 40.0 °C	TRA Workers 3.0
• Place of use: Indoor	TRA Workers 3.0

9.11.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.125. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.273 mg/m³ (TRA Workers)	RCR = 0.033
Inhalation, systemic, acute	0.273 mg/m³ (TRA Workers)	RCR = 0.012
Dermal, systemic, long term	0.034 mg/kg bw/day (TRA Workers)	RCR = 0.012
Combined routes, systemic, long-term		RCR = 0.045
Combined routes, systemic, acute		RCR = 0.012

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 3.68E-3 Pa.

The inhalation exposure is limited to the saturated vapour concentration (if relevant).

Risk characterisation

The Operational Conditions (OCs) and Risk Management Measures (RMMs) detailed in this contributing scenario ensure that the risk of TCPP exposure to workers is adequately controlled.

9.12. Exposure scenario 12: Service life (consumers) - Rigid foam, service life

Environment contributing scenario(s):		
CS 1	Rigid foam, service life	ERC 10a, ERC 11a
CS 2	Adhesive pressed (rigid) foam, service life	ERC 10a, ERC 11a
Consumer contributing scenario(s):		
CS 3	Plastic articles	AC 13

Exposure scenario(s) of the uses leading to the inclusion of the substance into the article(s):

ES3: Use at industrial sites - Rigid foam production

ES4: Widespread use by professional workers - Rigid (spray) foam, professional application

ES6: Use at industrial sites - Foam granules and rebound PUR foam

ES7: Widespread use by professional workers - One-component PUR foams, professional application (foaming)

ES8: Consumer use - One-component PUR foams, consumer application (foaming)

9.12.1. Env CS 1: Rigid foam, service life (ERC 10a)

9.12.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.023 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk)
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.12.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.126. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to air is not expected.
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:**

Release	Release estimation method	Explanations
		According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 100 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 20695.5 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 20695.5 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 2.07 t/y

Default release factor to water*): 0.0001

Amount of substance to water*): 2.07 t/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume20695.5 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 20695.5 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 33.1 t/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 80.98%

Amount of TCPP to water: 6.46 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 33.1 t/y released to soil is considered. The calculation of waste water effluent of 6.46 t/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.12.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.127. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The characteristics and use of the articles relevant for this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.12.2. Env CS 2: Adhesive pressed (rigid) foam, service life (ERC 10a)

9.12.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)

• Daily local widespread use amount: <= 0.00024 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk)
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.12.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.128. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 3.33E-3% **Release factor after on site RMM:** 3.33E-3% **Local release rate:** 8.06E-6 kg/day **Explanation:** The emission fraction to wastewater is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 3.33E-3% **Release factor after on site RMM:** 3.33E-3% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 100 %

50% incineration [TCPP EU RAR (ECB, 2008)]:

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 220 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 220 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 22 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 22 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

50% landfill [TCPP EU RAR (ECB, 2008)]:

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 (version 2.1, October 2012) exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 220 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 220 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 352 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.86%

Amount of TCPP to water: 68.7 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 352 kg/y released to soil is considered. The calculation of waste water effluent of 68.7 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.12.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.129. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.14E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.1E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 4E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 3.87E-6 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.09E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.56E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The characteristics and use of the articles relevant for this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.12.3. Cons CS 3: Plastic articles (AC 13)

9.12.3.1. Conditions of use

	Method
Product (article) characteristics	
• Exposure via dermal route: No dermal contact *The rigid foam is effectively sealed during use to prevent water contact of the foam. During use no contact of the consumer with the foam is intended. Therefore, dermal exposure is negligible.*	TRA Consumers 3.1 (R15)
• Exposure via oral route: Oral exposure is considered to be not relevant *The rigid foam is effectively sealed during use to prevent water contact of the foam. During use no contact of the consumer with the foam is intended. Therefore, oral exposure is negligible.*	TRA Consumers 3.1 (R15)

9.12.3.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.130. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	1 µg/m³ (Measured data: TCPP EU RAR, p. 184 (ECB, 2008))	RCR < 0.01
Inhalation, systemic, acute	1 µg/m³ (Measured data: TCPP EU RAR, p. 184 (ECB, 2008))	RCR < 0.01
Dermal, systemic, long term	0 mg/kg bw/day (TRA Consumers 3.1 (R15))	RCR < 0.01
Oral, systemic, long term	0 mg/kg bw/day (TRA Consumers 3.1 (R15))	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01

Route of exposure and type of effects	Exposure concentration	Risk quantification
Combined routes, systemic, acute		RCR < 0.01

Remarks on measured exposure:

TCPP EU RAR, p. 184 (ECB, 2008):

Identity of the substance used: TCPP

Explanation: Inhalation, systemic, long term

Should read <1 µg/m3

According to the TCPP EU RAR one rigid foam-producing company carried out a chamber test to check TCPP emerging from a closed-cell rigid foam intended for insulation purposes. This spray-foam has also been developed for potential indoor-air application, which was the driving force behind the chamber-test. The foam had a thickness of 10 cm (regarded to be the upper limit for indoor-application) and contained 9% TCPP. The surface to volume ratio of the test-specimen was 1.4 m2/m3, which is considered to represent a typical real-life scenario. For the test, a concrete plate was covered with a layer of the spray foam and then transferred into a test chamber in the test laboratory. The volume of the test chamber was 119 litres, temperature 23°C and relative humidity 50%. The air exchange rate was 0.5 air changes per hour (ACH). The loading of the test chamber was 1.4 m2 test specimen per m3 air volume. Air sampling from the chamber outlet air was carried out after 3 and after 28 days onto Tenax TA, followed by thermal desorption, gas chromatography and mass spectroscopy. The method applied was based on published methods. No TCPP could be detected (detection limit was 1 µg/m3).

The authors of the TCPP EU RAR concluded from that work that consumers are potentially exposed to negligible amounts of TCPP in rooms containing closed-cell rigid foam (ECB, 2008).

Inhalation, systemic, acute

Should read <1 µg/m3

According to the TCPP EU RAR one rigid foam-producing company carried out a chamber test to check TCPP emerging from a closed-cell rigid foam intended for insulation purposes. This spray-foam has also been developed for potential indoor-air application, which was the driving force behind the chamber-test. The foam had a thickness of 10 cm (regarded to be the upper limit for indoor-application) and contained 9% TCPP. The surface to volume ratio of the test-specimen was 1.4 m2/m3, which is considered to represent a typical real-life scenario. For the test, a concrete plate was covered with a layer of the spray foam and then transferred into a test chamber in the test laboratory. The volume of the test chamber was 119 litres, temperature 23°C and relative humidity 50%. The air exchange rate was 0.5 air changes per hour (ACH). The loading of the test chamber was 1.4 m2 test specimen per m3 air volume. Air sampling from the chamber outlet air was carried out after 3 and after 28 days onto Tenax TA, followed by thermal desorption, gas chromatography and mass spectroscopy. The method applied was based on published methods. No TCPP could be detected (detection limit was 1 µg/m3).

The authors of the TCPP EU RAR concluded from that work that consumers are potentially exposed to negligible amounts of TCPP in rooms containing closed-cell rigid foam (ECB, 2008).

Risk characterisation

The characteristics and use of the article in this contributing scenario ensure that the risk of TCPP exposure to consumers is adequately controlled.

9.13. Exposure scenario 13: Service life (consumers) - Flexible foam, service life

Environment contributing scenario(s):		
CS 1	Flexible foam, service life	ERC 10a, ERC 11a
CS 2	Rebonded (flexible) foam, service life	ERC 10a, ERC 11a
CS 3	Loose crumb (flexible) foam, service life	ERC 10a, ERC 11a
Consumer contributing scenario(s):		
CS 4	Vehicles	AC 1
CS 5	Fabrics, textiles and apparel	AC 5

Exposure scenario(s) of the uses leading to the inclusion of the substance into the article(s):

ES5: Use at industrial sites - Flexible foam production

ES6: Use at industrial sites - Foam granules and rebound PUR foam

9.13.1. Env CS 1: Flexible foam, service life (ERC 10a)

9.13.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.0024 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk)
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.13.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.131. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 9.6E-3% **Release factor after on site RMM:** 9.6E-3% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008)

Release	Release estimation method	Explanations
		direct release to soil is not expected.

Releases to waste

Release factor to external waste: 100 %

20% incineration of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 889.2 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 889.2 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 88.9 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 88.9 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 3556.8 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 3556.8 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 5.69 t/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 13.9%

Amount of TCPP to water: 1.11 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (v. 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 5.69 t/y released to soil is considered. The calculation of waste water effluent of 1.11 t/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.13.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.132. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The characteristics and use of the articles relevant for this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.13.2. Env CS 2: Rebonded (flexible) foam, service life (ERC 10a)

9.13.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)

• Daily local widespread use amount: <= 0.0003 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk)
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.13.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.133. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 9.6E-3% **Release factor after on site RMM:** 9.6E-3% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 100 %

20% incineration of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 109.8 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 109.8 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 11.0 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 11.0 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage.

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 439.2 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 439.2 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 703 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 1.72%

Amount of TCPP to water: 137 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage.

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data. Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 703 kg/y released to soil is considered. The calculation of waste water effluent of 137 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.13.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.134. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The characteristics and use of the articles relevant for this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.13.3. Env CS 3: Loose crumb (flexible) foam, service life (ERC 10a)

9.13.3.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.00013 tonnes/day
• Percentage of EU tonnage used at regional scale: = 10.0 %
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations: No (low risk)
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 3.887%]

9.13.3.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.135. Local releases to the environment

Release	Release estimation method	Explanations
Water	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0% **Release factor after on site RMM:** 0% **Local release rate:** 0 kg/day **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008)

Release	Release estimation method	Explanations
		direct release to wastewater is not expected.
Air	Estimated release factor (TCPP EU RAR)	**Release factor before on site RMM:** 0.096% **Release factor after on site RMM:** 0.096% **Explanation:** The emission fraction to air is defined according to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008).
Non agricultural soil	Estimated release factor (TCPP EU RAR)	**Release factor after on site RMM:** 0% **Explanation:** According to the EU Risk Assessment Report (RAR) for TCPP (ECB, 2008) direct release to soil is not expected.

Releases to waste

Release factor to external waste: 100 %

20% incineration of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Incineration in hazardous or municipal waste incineration plant

Assumption: The incineration plant is operated according to the legal requirements. The incinerator is equipped with wet flue-gas cleaning devices and secondary wastes are disposed of by landfill or in road construction.

Physical form: Substance is contained in solid waste

Operational conditions: Operation temperature according to the requirements of the Incineration Directive (850 or 1100°C).

Production volume: 47 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 47 t/y

Release time: 330 d/y

Default release factor to air*)#): 0.0001

Amount of substance to air: 4.7 kg/y

Default release factor to water*): 0.0001

Amount of substance to water*): 4.7 kg/y

Water treatment§): 100%

Amount of substance to water after pre-treatment: 0 t/y

Default release factor to soil*): 0

Amount of substance to soil: 0 t/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage.

#)Taking into account the low vapour pressure of TCPP release factor to air is considered to be overestimated.

§)All water is collected and treated in STP.

Conclusion: For waste incineration only emissions to air are considered relevant. TCPP boils with decomposition at 288°C. At temperatures applied during incineration (850 or 1100°C) total decomposition of TCPP is assumed. Emission to air is assumed to be negligible.

80% landfill of municipal waste ECHA guidance R.18 (v. 2.1, October 2012):

Title: Defaults for landfill scenario

Assumption: It is assumed that the landfill is operated according to Landfill Directive and well defined standards according to ECHA guidance R.18 exist.

Physical form: Substance is contained in solid waste

Operational conditions: According to the requirements of the Landfill Directive.

Production volume: 188 t/y

Fraction of substance becoming waste (worst case assumption): 100%

Amount if substance in waste: 188 t/y

Release time: 365 d/y

Default release factor to air*)#): 0

Amount of substance to air: 0 kg/y

Default release factor to soil*): 0.0016

Amount of substance to soil: 301 kg/y

Estimated total release to water as sum of all uses§): 7981 kg/y

Share of total TCPP waste disposed to landfill$): 0.74%

Amount of TCPP to water: 58.7 kg/y

*)Default value proposed in ECHA guidance R.18: Exposure scenario building and environmental release estimation for the waste life stage (version 2.1, October 2012)

#)The release factor to air is taken for non-VOC as TCPP does not fulfill the VOC criteria given in guideline 2004/42/EG.

§)According to TCPP EU RAR a regional release of 1.64 kg/d is assessed based on landfill effluent measured data (ECB, 2008). Considering 10 regions in EU, the yearly EU waste water effluent is calculated (daily effluent multiplied with 365 d/y and 10 regions). This tonnage considers all EU TCPP waste disposals to landfill and is not specific for this use.

TCPP EU RAR relied on total EU production volume from 4 production sites (3 in Germany and 1 in UK) in 2000 (i.e. 36000 t TCPP).

In 2015 the total volume of TCPP manufactured by 'TCPP REACH consortium' members in EU is 48000 t.

Regional release assessed in TCPP EU RAR is corrected accordingly (multiplied with 1.33) as conservative assessment.

$)The waste share is calculated considering total amount of TCPP in waste disposed to landfill (sum of all uses) and amount disposed to landfill for this specific use.

Conclusion: For landfill only emissions to soil and waste water are considered relevant. In this conservative assessment a maximum amount of 301 kg/y released to soil is considered. The calculation of waste water effluent of 58.7 kg/y is considering measured data from TCPP EU RAR and total volume of TCPP in EU.

9.13.3.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.136. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Fresh water	**Local PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Local PEC:** 4.09E-3 mg/kg dw	RCR < 0.01
Marine water	**Local PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Local PEC:** 3.99E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**Local PEC:** 0 mg/L	RCR < 0.01
Agricultural soil	**Local PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**Local PEC:** 1.59E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**Local PEC:** 1.55E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**Local PEC:** 5.55E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01

Protection target	Exposure concentration	Risk quantification
Man via environment - Oral	**Exposure via food consumption:** 3.29E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Risk characterisation

The characteristics and use of the articles relevant for this contributing scenario ensure that the risk of TCPP exposure to the environment is adequately controlled.

9.13.4. Cons CS 4:Vehicles (AC 1)

Cars are taken as worst case for vehicles containing TCPP, because of the small room air.

9.13.4.1. Conditions of use

	Method
Product (article) characteristics	
• [ConsExpo] Weight fraction of the compound of interest: 25.0 % *The TCPP content varies between 0 and 25% (w/w) in the final foam. Therefore, a maximum TCPP concentration of 25% (w/w) can be regarded as reasonable worst case.*	ConsExpo 4.1
• [ConsExpo] Vapour pressure (at application temperature): < 0.0037 Pa	ConsExpo 4.1
• Exposure via dermal route: No dermal contact *As all flexible foams containing TCPP in the car are built in the car covered by plastic or metal no direct contact of the consumer to the foam is intended.Therefore, dermal exposure is considered negligible.*	ConsExpo 4.1
• Exposure via oral route: Oral exposure is considered to be not relevant *As all flexible foams containing TCPP in the car are built in the car covered by plastic or metal no direct contact of the consumer to the foam is intended.Therefore, oral exposure is considered negligible.*	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• [ConsExpo] Use frequency: 1.0 times/day	ConsExpo 4.1
• [ConsExpo] Exposure duration (time): 480.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Release duration: 480.0 min	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Applied amount: 2000 g *It is assumed that 2000 g ofTCPP containing foam is build in the car.*	ConsExpo 4.1
Information and behavioral advice for consumers	
• [ConsExpo] Inhalation exposure model / Ventilation rate: 0.5 air changes/hour	ConsExpo 4.1
Other conditions affecting consumers exposure	
• [ConsExpo] Application temperature: 40.0 °C *A temperature of 40 °C is taken as reasonable worst case to reflect the use of vehicles durring summer.*	ConsExpo 4.1
• [ConsExpo] Body weight: 65.0 kg	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Room volume: 2.0 m3 *A room size of 2 m3 is taken for assessment.*	ConsExpo 4.1
• [ConsExpo] Details Assessment tool: ConsExpo v4.1 for inhalation exposure	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model: Exposure to vapour - Constant rate	ConsExpo 4.1
• [ConsExpo] Inhalation exposure model / Air concentration limited to the vapour pressure of the pure	ConsExpo 4.1

	Method
substance?: yes	

9.13.4.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.137. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	0.155 mg/m³ (ConsExpo 4.1)	RCR = 0.107
Inhalation, systemic, acute	0.464 mg/m³ (ConsExpo 4.1)	RCR = 0.083
Dermal, systemic, long term	0 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Oral, systemic, long term	0 mg/kg bw/day (ConsExpo 4.1)	RCR < 0.01
Combined routes, systemic, long-term		RCR = 0.107
Combined routes, systemic, acute		RCR = 0.083

Risk characterisation

The characteristics and use of the article in this contributing scenario ensure that the risk of TCPP exposure to consumers is adequately controlled.

9.13.5. Cons CS 5: Fabrics, textiles and apparel (AC 5)

According to the TCPP EU RAR most of the TCPP used in flexible foam is used in upholstery and bedding. Consumers do not come into direct contact with these foams. The foam is only used in ways in which it is enclosed and therefore it is expected that consumer exposure to TCPP from these foams is very low (ECB, 2008).

9.13.5.1. Conditions of use

Conditions of Use were not defined for this Contributing scenario.

9.13.5.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.138. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, systemic, long term	3.8 µg/m³ (Measured data: TCPP EU RAR, p. 181 ff (ECB, 2008))	RCR < 0.01
Inhalation, systemic, acute	3.8 µg/m³ (Measured data: TCPP EU RAR, p. 181 ff (ECB, 2008))	RCR < 0.01
Dermal, systemic, long term	1.1E-3 mg/kg bw/day (Measured data: TCPP EU RAR, p. 181 ff (ECB, 2008))	RCR < 0.01
Oral, systemic, long term	0.037 µg/kg bw/day (Measured data: TCPP EU RAR, p. 181 ff (ECB, 2008))	RCR < 0.01
Combined routes, systemic, long-term		RCR < 0.01
Combined routes, systemic, acute		RCR < 0.01

Remarks on measured exposure:

TCPP EU RAR, p. 181 ff (ECB, 2008):

Identity of the substance used: TCPP

Inhalation exposure, long term concentration: Number of measured data points: 18

Explanation: Inhalation, systemic, long term

Chamber tests of TCPP-containing flexible PUR foams for release of TCPP:

In order to evaluate possible indoor air concentrations of TCPP from flexible foam used in mattresses, EUROPUR (European Association of Flexible Polyurethane Foam Block Manufacturers) ordered chamber tests at the Institute Miljo-Kemi in Denmark. In the study, a 'worst-case' scenario was applied. The foams were uncovered, the quantity of foam in the mattress was a maximum (i.e. full depth foam with no springs) and the chamber volume was small. In everyday use, the mattress foam is always covered with a fabric material and bedding sheets, blankets, etc. Three types of flexible PUR foam used in mattresses were tested. The samples were 2000 x 1000 x 120 mm of full depth foam (i.e. no springs), were uncovered and were reported to contain TCPP at the high end of the typical level for this application (reported to be 2.5 – 14%, 7 – 8% on average, based on industry data collected for the risk assessment of TCPP). The mattresses were placed in a 3.2 m3 test chamber at 23°C and relative humidity of 50% with an air exchange rate of 0.5 per hour. Volatile emissions were collected on Tenax TA absorbent and analysed by GC-MS.

The authors of the TCPP EU RAR concluded that an estimation of TCPP indoor air concentration can be made from this study. It was indicated by the authors that as a worst-case approach, a room with a high PUR foam load should be assumed. (ECB, 2008, p. 181).

Therefore, the following assumtions are considered to reflect a reasonable worst case: TCPP concentration in chamber air: 19 µg/m3; Mattresses in the room: 2 (Factor 2); Volume of room: 30 m3 (Factor 1/10) and Air exchange: 0.5 1/h (Factor 1).

The authors of the TCPP EU RAR estimated based on the aforementioned that From this study, the concentration of 3.8 µg/m3 TCPP in indoor air in rooms with a high load of flame retarded flexible PUR foam (ECB, 2008, p. 181).

Inhalation, systemic, acute

see above

Dermal, systemic, long term

According to the TCPP EU RAR is there are no data on dermal exposure. However, the authors considered it reasonable to assume that dermal exposure will not exceed inhalation exposure and concluded thatthe data on inhalation exposure are suitable for dermal exposure as a reasonable worst case (ECB, 2008, p. 183).

Oral, systemic, long term

According to the TCPP EU RAR is this route of exposure only of significance for young children, due to their hand to mouth behaviour (ECB, 2008). For assessment information has been taken from the TCPP exposure assessment in the TCPP EU RAR and a study on TCPP in house dust by Ingerowski et al. (2001). In an interlaboratory comparative study published by Ingerowski et al. (2001), TCPP dust concentrations have been measured in 436 German households by three different laboratories using identical methodology. It has been shown that the amount of TCPP in house dust ranges from 0.1 to 375 mg/kg dust with a 95th percentile of 3.4 mg/kg dust (ECB, 2008, p. 106).

The observed range of dust concentration is in agreement with other also recent studies conducted in Europe using smaller sample sizes (Bergh et al., 2011: 0.1-11 mg/kg [n = 10]; Brandsma et al., 2014: 0.5-4.5 mg/kg [n=8]; Brommer et al., 2012: 0.37-0.96 mg/kg [n=6]; Covaci et al., 2010: 0.2-73.7 mg/kg [n= 33]; van den Eede et al.,2015: 0.2-73.7 mg/kg [n= 33]; Dirtu et al., 2010: 4.8 mg/kg [n=33]; Fromme et al., 2014: 0.71 – 47.0 mg/kg [n= 63]).

For calculation of oral TCPP uptake the authors of the TCPP EU RAR used the dust uptake and body weight data (normal distribution, weighted for 1 to 3 year of age) given the AUH Report (1995). Based on this data the authors of the TCPP EU RAR estimated that a three year old child (body weight: 9.1 kg) would consume 100 mg dust per day (including soil). The dust uptake data are primarily based on the data published by Calabrese et al. (1989). As this estimation of uptake includes soil uptake the authors of the TCPP EU RAR concluded that this leads to a slight overestimate of exposure via dust (ECB, 2008, p. 183 f).

Risk characterisation

The characteristics and use of the article in this contributing scenario ensure that the risk of TCPP exposure to consumers is adequately controlled.

10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE

10.1. Human health

10.1.1. Workers

10.1.2. Consumer

10.2. Environment (combined for all emission sources)

10.2.1. All uses (regional scale)

10.2.1.1. Total releases

The total releases to the environment from all the exposure scenarios covered are presented in the table below. This is the sum of the releases to the environments from all exposure scenarios addressed.

Where there is more than one contributing scenario for the environment for a given exposure scenario, the highest release per route across all the contributing scenarios within the use has been taken into account as the release for the use (both for the regional and the exposure due to all the widespread uses). This may lead to overestimation of the PEC.

Table 10.1. Total releases to the environment per year from all life cycle stages

Release route	Total releases per year
Water	1.15E4 kg/year
Air	2.5E4 kg/year
Soil	0 kg/year

10.2.2. Regional assessment

The regional predicted environmental concentration (PEC regional) and the related risk characterisation ratios when a PNEC is available are presented in the table below. The exposure to man via the environment from regional exposure and the related risk characterisation ratios are also provided (when relevant). The exposure concentration for human via inhalation is equal to the PEC air.

The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 10.2. Predicted regional exposure concentrations (Regional PEC) and risks for the environment

Protection target	Regional PEC	Risk characterisation
Fresh water	**Regional PEC:** 1.13E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**Regional PEC:** 4.67E-3 mg/kg dw	RCR < 0.01
Marine water	**Regional PEC:** 1.11E-5 mg/L	RCR < 0.01
Sediment (marine water)	**Regional PEC:** 4.12E-4 mg/kg dw	RCR < 0.01
Agricultural soil	**Regional PEC:** 8.08E-4 mg/kg dw	RCR < 0.01
Man via environment - Inhalation	**Concentration in air:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**Exposure via food consumption:** 1.74E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Remarks on risk characterisation for regional concentrations:

The calculated values for the regional exposure to the environment are considered to display an overestimate as for some of the contributing scenarios annual worst-case tonnages are used. This results in multi-metering of tonnages.

The calculated values for the regional exposure to 'Man via the environment' are considered to display an overestimate as for some of the contributing scenarios annual worst-case tonnages are used. This results in multi-metering of tonnages.

10.2.3. Local exposure due to all widespread uses

The predicted local environmental concentrations (PEC local) and the exposure to man via the environment (when relevant) based on the releases from all widespread uses are reported in the table below, when relevant, together with the risk characterisation ratio when a PNEC is available. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 10.3. Predicted exposure concentrations and risks for the environment and man via the environment due to all widespread uses

Protection target	PEC local due to all widespread uses	Risk characterisation
Fresh water	**PEC:** 1.22E-4 mg/L	RCR < 0.01
Sediment (freshwater)	**PEC:** 4.39E-3 mg/kg dw	RCR < 0.01
Marine water	**PEC:** 1.19E-5 mg/L	RCR < 0.01
Sediment (marine water)	**PEC:** 4.29E-4 mg/kg dw	RCR < 0.01
Sewage Treatment Plant	**PEC:** 8.32E-5 mg/L	RCR < 0.01
Agricultural soil	**PEC:** 8.3E-4 mg/kg dw	RCR < 0.01
Predator's prey (freshwater)	**PEC:** 1.65E-3 mg/kg ww	RCR < 0.01
Predator's prey (marine water)	**PEC:** 1.61E-4 mg/kg ww	RCR < 0.01
Top predator's prey (marine water)	**PEC:** 1.56E-4 mg/kg ww	RCR < 0.01
Predator's prey (terrestrial)	**PEC:** 5.65E-4 mg/kg ww	RCR < 0.01
Man via environment - Inhalation	**PEC:** 1.26E-8 mg/m³	RCR < 0.01
Man via environment - Oral	**PEC:** 3.37E-5 mg/kg bw/day	RCR < 0.01
Man via environment - combined routes		RCR < 0.01