Fiche de données de sécurité
selon 1907/2006/CE, Article 31

Date d'impression : 30.05.2011 *Numéro de version 19* *Révision: 30.05.2011*

*
1 Identification de la substance/du mélange et de la société/l'entreprise

· ***Identificateur de produit***

· Nom du produit: ***AMMONIAQUE <25%***
AMMONIAQUE 20.5% ou Alcali 22°Be

· Code du produit: *0012*
· Numéro d'enregistrement *Voir Chapitre 3*
· Utilisations identifiées pertinentes de la substance ou du mélange et utilisations déconseillées
· Emploi de la substance / de la préparation *Produits chimiques agricoles*
Produit chimique pour synthèses
Détergents de surface
Décapant

· ***Renseignements concernant le fournisseur de la fiche de données de sécurité***
· Producteur/fournisseur:

Société CHARBONNEAUX BRABANT	*TEL: 03-26-49-58-70*
Société P. BRABANT	*TEL: 03-20-41-28-05*
Société FLOURENT BRABANT	*TEL: 03-20-41-28-05*
Société BRABANT CHIMIE	*TEL: 02-38-87-81-75*
Société HAUGUEL Saint Ouen	*TEL: 01-30-37-00-04*
Société HAUGUEL Gonfreville	*TEL: 02-32-79-55-00*

· Service chargé des renseignements: *Service Sécurité de la société CHARBONNEAUX BRABANT*
5 rue de Valmy - Z.I. Port Sec - BP 341
51062 REIMS CEDEX
Tel: 03 26 49 58 70
Courriel: chimie@charbonneaux.com
· Numéro d'appel d'urgence: *ORFILA téléphone: 01 45 42 59 59*
SAMU : 15
POMPIERS: 18
Pour connaître la liste des médecins de garde contactez le 15.
Emergency Number 112

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2 Identification des dangers

· ***Classification de la substance ou du mélange***

· Classification selon le règlement (CE) n°1272/2008

GHS05 corrosion

Skin Corr. 1B H314 Provoque des brûlures de la peau et des lésions oculaires graves.

GHS07

STOT SE 3 H335 Peut irriter les voies respiratoires.

· Classification selon la directive 67/548/CEE ou directive 1999/45/CE

C; Corrosif

R34: Provoque des brûlures.

· ***Éléments d'étiquetage***

· Etiquetage selon le règlement (CE) n° 1272/2008 *Le produit est classifié et étiqueté selon le règlement CLP.*
· Pictogrammes de danger

GHS05 GHS07

· Mention d'avertissement *Danger*

· Composants dangereux déterminants pour l'étiquetage: *ammoniaque*
· Mentions de danger *H314 Provoque des brûlures de la peau et des lésions oculaires graves.*
H335 Peut irriter les voies respiratoires.

· Conseils de prudence

P280	*Porter des gants de protection/des vêtements de protection/un équipement de protection des yeux/du visage.*
P261	*Éviter de respirer les brouillards/vapeurs/aérosols.*
P303+P361+P353	*EN CAS DE CONTACT AVEC LA PEAU (ou les cheveux): enlever immédiatement les vêtements contaminés. Rincer la peau à l'eau/se doucher.*
P305+P351+P338	*EN CAS DE CONTACT AVEC LES YEUX: rincer avec précaution à l'eau pendant plusieurs minutes. Enlever les lentilles de contact si la victime en porte et si elles peuvent être facilement enlevées. Continuer à rincer.*

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P310	Appeler immédiatement un CENTRE ANTIPOISON ou un médecin.
P304+P340	EN CAS D'INHALATION: transporter la victime à l'extérieur et la maintenir au repos dans une position où elle peut confortablement respirer.
P301+P330+P331	EN CAS D'INGESTION: rincer la bouche. NE PAS faire vomir.
P403+P233	Stocker dans un endroit bien ventilé. Maintenir le récipient fermé de manière étanche.
P501	Éliminer le contenu/récipient conformément à la réglementation locale/ régionale/nationale/internationale.

· **Autres dangers**
· Résultats des évaluations PBT et vPvB
· PBT: Le produit ne possède pas de propriétés PBT telles que définies à l'annexe XIII du règlement (CE) n°1907/2006.
· vPvB: Le produit ne possède pas de propriétés vPvB telles que définies à l'annexe XIII du règlement (CE) n°1907/2006.

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3 Composition/informations sur les composants

· **Caractérisation chimique: Mélanges** Mélange à base de : Ammoniaque (NH3, H2O ou NH4+)
N°Enregistrement REACH: Ammoniac (CAS: 7664-41-7): 01-2119488876-14-xxxx

· Composants dangereux:

CAS: 1336-21-6 EINECS: 215-647-6 Numéro index: 007-001-01-2	ammoniaque	C R34; N R50 Skin Corr. 1B, H314; Aquatic Acute 1, H400; STOT SE 3, H335	<25%

· SVHC néant
· Règlement (CE) No 648/2004 relatif aux détergents / Étiquetage du contenu Non applicable
· Indications complémentaires: Pour le libellé des phrases de risque citées, se référer au chapitre 16.

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4 Premiers secours

· **Description des premiers secours**
· Remarques générales: Contacter le personnel secouriste et le service Hygiène Sécurité Environnement.
LA RAPIDITE EST ESSENTIELLE.
· Après inhalation: En cas d'inconscience, coucher et transporter la personne en position latérale stable.
Demander immédiatement conseil à un médecin.
Amener les sujets à l'air frais et les garder au calme.
· Après contact avec la peau: Laver immédiatement à l'eau.
Enlever immédiatement les vêtements contaminés par le produit.
En cas d'irritation persistante de la peau, consulter un médecin.
· Après contact avec les yeux: Rincer les yeux, pendant 15 minutes, sous l'eau courante en écartant bien les paupières et consulter un ophtalmologiste
Vérifier que la victime ne porte pas de verres de contact, les retirer.
· Après ingestion: Tourner sur le côté une personne couchée sur le dos, qui est en train de vomir.
Ne pas faire vomir sauf indication contraire du corps médical
Demander immédiatement conseil à un médecin.
· Indications destinées au médecin:
· Principaux symptômes et effets, aigus et différés Irritant pour les yeux , la peau et les muqueuses
· Risques Risque de perforation gastrique.
Lors de contacts prolongés: risque de brulures
Suite à une exposition sévère, le patient doit être placé sous surveillance médicale pendant 48h minimum, un oedème pulmonaire différé peut se développer.

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5 Mesures de lutte contre l'incendie

· **Moyens d'extinction**
· Moyens d'extinction: Eau pulvérisée
Mousse
Poudre d'extinction
Dioxyde de carbone
Adapter les mesures d'extinction d'incendie à l'environnement.
· **Dangers particuliers résultant de la substance ou du mélange** Possibilité de formation de gaz toxiques en cas d'échauffement ou d'incendie.
Oxyde d'azote (NOx)
Monoxyde de carbone (CO)
Dioxyde de carbone
Des vapeurs d'ammoniac peuvent être émises. Dans le cas d'un dégagement d'ammoniac à l'air, le ratio ammoniac/air dépasse généralement les limites d'explosivité (16-25%(vol.)). Sous l'action de la chaleur, le risque d'inflammation ou d'explosion du mélange ammoniac/air à l'extérieur des bâtiments est négligeable. Cependant, dans un espace confiné, la situation est différente, le risque d'explosion peut être possible en présence d'une source d'ignition. Les containers peuvent exploser sous l'effet de la chaleur.
· **Conseils aux pompiers**
· Equipement spécial de sécurité: Porter un appareil de respiration indépendant de l'air ambiant.
Ne pas inhaler les gaz d'explosion et les gaz d'incendie.

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· **Autres indications** Refroidir les récipients en danger en pulvérisant de l'eau.

*
6 Mesures à prendre en cas de dispersion accidentelle

· **Précautions individuelles, équipement de protection et procédures d'urgence** Porter un appareil de protection respiratoire.
Porter un équipement de sécurité. Eloigner les personnes non protégées.
Eviter le contact avec la peau et les yeux
NE PAS TOUCHER ni marcher dans le produit répandu.

· **Précautions pour la protection de l'environnement:** Ne pas rejeter dans les canalisations, dans les eaux de surface et dans les nappes d'eau souterraines.

· **Méthodes et matériel de confinement et de nettoyage:** Recueillir les liquides à l'aide d'un produit absorbant (sable, kieselguhr, neutralisant d'acide, liant universel, sciure).
Utiliser un neutralisant.
Evacuer les matériaux contaminés en tant que déchets conformément au point 13.
Assurer une aération suffisante.

· **Référence à d'autres sections** Afin d'obtenir des informations pour une manipulation sûre, consulter le chapitre 7.
Afin d'obtenir des informations sur les équipements de protection personnels, consulter le chapitre 8.
Afin d'obtenir des informations sur l'élimination, consulter le chapitre 13.

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7 Manipulation et stockage

· **Manipulation:**
· Précautions à prendre pour une manipulation sans danger Veiller à une bonne ventilation/aspiration du poste de travail.
Ouvrir et manipuler les récipients avec précaution.
Porter les équipements de protection requis avant toute manipulation (voir chapitre 8)
Reporter l'étiquetage d'origine sur tout récipient utilisé pour un prélèvement.
Prévoir des douches et fontaines oculaires sur les lieux d'utilisation.
· Préventions des incendies et des explosions: Les équipements appropriés pour faire face aux incendies, les déversements et les fuites doivent être facilement accessibles.
Tenir à l'abri de la chaleur.
Tenir à l'abri des sources d'inflammation - ne pas fumer.

· **Conditions d'un stockage sûr, y compris d'éventuelles incompatibilités**
· Stockage:
· Exigences concernant les lieux et conteneurs de stockage: Prévoir une cuvette de rétention
Stocker dans un endroit frais.
Ne conserver que dans le fût d'origine.
Prévoir des sols résistant aux solutions alcalines.
N'utiliser que des emballages spécialement agréés pour la matière/le produit.
· Indications concernant le stockage commun: Ne pas stocker avec les aliments.
Ne pas stocker avec des substances oxydantes ou acides.
· Autres indications sur les conditions de stockage: Conserver les emballages dans un lieu bien aéré.
Stocker au frais et au sec dans des fûts bien fermés.
Protéger de la forte chaleur et du rayonnement direct du soleil.
· **Utilisation(s) finale(s) particulière(s)** Pas d'autres informations importantes disponibles.

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8 Contrôles de l'exposition/protection individuelle

· **Indications complémentaires pour l'agencement des installations techniques:** Sans autre indication, voir point 7.

· **Paramètres de contrôle**

· Composants présentant des valeurs-seuil à surveiller par poste de travail:	
1336-21-6 ammoniaque	
VLE (France)	Valeur momentanée: 14 mg/m³, 20 ppm
VME (France)	Valeur momentanée: 7 mg/m³, 10 ppm

· DNEL
1336-21-6 ammoniaque

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DNEL	(CONSOMMATEURS) (Ammoniac gazeux) Inhalation (aigue, local): 7.2mg/m3 Inhalation (aigue, systémique): 23.8mg/m3 Inhalation (long terme, local): 2.8mg/m3 Inhalation (long terme, systémique): 23.8mg/m3 Dermal (aigue, systémiques): 68mg/kg/j Dermal (long terme, systémique): 68mg/kg/j Ingestion (aigue, systémique): 6.8mg/kg/j Ingestion (long terme, systémique): 6.8mg/kg/j (TRAVAILLEURS) (Ammoniac gazeux) Inhalation (aigue, local): 36mg/m3 Inhalation (aigue, systémique): 47.6mg/m3 Inhalation (long terme, local): 14mg/m3 Inhalation (long terme, systémique): 47.6mg/m3 Dermal (aigue, systémiques): 68mg/kg/j Dermal (long terme, systémique): 68mg/kg/j

· PNEC

1336-21-6 ammoniaque

PNEC	(-) (Ammoniac gazeux) Eau douce: 0.0011mg/l Eau de mer: 0.0011mg/l Eau, rejet intermittent: 0.089mg/l Sédiment: -

· Remarques supplémentaires: *Le présent document s'appuie sur les listes en vigueur au moment de son élaboration.*

· ***Contrôles de l'exposition*** *Les mesures de controle appropriées pour un lieu de travail particulier dépendent de la façon dont le produit est utilisé et du potentiel d'exposition.*
Si les contrôles techniques et les modes opératoires ne sont pas efficaces dans la prévention ou le contrôle de l'exposition, les équipements de protections individuels, qui donnent des résultats satisfaisants, doivent être utilisés.

· Equipement de protection individuel:

· Mesures générales de protection et d'hygiène: *Respecter les mesures de sécurité usuelles pour l'utilisation de produits chimiques.*
Tenir à l'écart des produits alimentaires, des boissons et de la nourriture pour animaux.
Retirer immédiatement les vêtements souillés ou humectés.
Se laver les mains avant les pauses et en fin de travail.
Ne pas inhaler les gaz, les vapeurs et les aérosols.
Eviter tout contact avec les yeux et avec la peau.
Favoriser la mise en place de mesures de protection collectives par rapport aux mesures de protection individuelle.

· Protection respiratoire: *Utiliser un appareil de protection respiratoire si la ventilation est insuffisante.*
En cas de risque d'exposition au delà des valeurs moyennes d'exposition, port obligatoire d'un équipement individuel de protection respiratoire.
Utiliser des appareils conformes à une norme approuvée.

· Filtre recommandé pour une utilisation momentanée: *Attention! Les filtres ont une durée d'utilisation limitée.*
Filtre combiné adéquat par exemple ABEK- P2

· Protection des mains:

Gants de protection

Norme EN 374
Se référer aux informations sur les résistances chimiques de chaque gant et mener un essai préalable pour déterminer si le gant est adapté aux conditions d'utilisations réelles.
Changer regulièrement les gants.
Contrôler la perméabilité avant chaque nouvelle utilisation du gant.
Choix du matériau des gants en fonction des temps de pénétration, du taux de perméabilité et de la dégradation.

· Matériau des gants *Le choix de gants appropriés ne dépend pas seulement du matériau, mais également d'autres critères de qualité qui peuvent varier d'un fabricant à l'autre.*

· Temps de pénétration du matériau des gants *Le temps de pénétration exact est à déterminer par le fabricant des gants de protection et à respecter.*

· Protection des yeux:

Lunettes de protection hermétiques

· Protection du corps: *Vêtements de travail protecteurs*

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9 Propriétés physiques et chimiques

· ***Informations sur les propriétés physiques et chimiques essentielles***
· Indications générales.
· Aspect:
Forme: *Liquide*
Couleur: *Incolore*
· Odeur: *Caractéristique*
· Seuil olfactif: *5-25 ppm*

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· valeur du pH:	*11,7 (solution à 1%)*
· Changement d'état	
Point de fusion:	*-35°C (NH3 20%)*
Point d'ébullition:	*45°C (NH3 20%)*
· Point d'inflammation:	*Non applicable.*
· Inflammabilité (solide, gazeux):	*Non applicable.*
· Température d'inflammation:	
Température de décomposition:	*450°C (Ammoniac gazeux)*
· Auto-inflammation:	*Le produit ne s'enflamme pas spontanément.*
· Danger d'explosion:	*Le produit n'est pas explosif.*
· Limites d'explosion:	
Inférieure:	*16 Vol % (ammoniac gazeux)*
Supérieure:	*25 Vol % (ammoniac gazeux)*
· Pression de vapeur:	*Non déterminé.*
· Densité à 20°C:	*923 kg/m3 (NH3 20%)*
· Densité de vapeur. à 20°C	*0,717 g/cm³ (ammoniac gazeux)*
· Solubilité dans/miscibilité avec l'eau:	*Soluble*
· Coefficient de partage (n-octanol/eau):	*Non déterminé.*
· ***Autres informations***	*Pas d'autres informations importantes disponibles.*

*
10 Stabilité et réactivité

· ***Réactivité***
· Stabilité chimique
· Décomposition thermique/conditions à éviter: *Pas de décomposition en cas d'usage conforme.*
· ***Conditions à éviter*** *Chaleur / source de chaleur*
La lumière solaire directe
Température supérieure à : 35°C
· ***Matières incompatibles:*** *Acides et sels(H2SO4,HClO4)*
Halogènes: fluor,chlore,brome,iode
Halogénures métalloïdiques
Cuivre,zinc et alliages
hypochlorites alcalins
Incompatible avec l'acroléine, le nitrométhane, lacide acrylique, l'acide chlorosulfonique, le sulfate de dimethyle, l'oxude de propylène, le nitrate d'argent
Réactions explosives avec l'aldéhyde acétique, l'acide hypochloreux, l'hexacyanoferrate de potassium
· ***Produits de décomposition dangereux:*** *ammoniac*

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11 Informations toxicologiques

· ***Informations sur les effets toxicologiques***

· **Toxicité aiguë:**

· Valeurs LD/LC50 déterminantes pour la classification:

1336-21-6 ammoniaque

Oral	*LD50*	*350 mg/kg (RAT)*
Inhalatoire	*LC50*	*7035 mg/m3 (RAT) ((30min))*
	NOAEL	*67 (-) (mg/kg/j Ammoniac gazeux)*
		68mg/kg/j (RAT) (29 jours)
		L'exposition chronique entraîne une tolérance: l'odeur est perçue et les effets irritants surviennent à des concentrations plus élevées qu'initialement.

· Par voie orale: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*
· Par voie cutanée: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*
· Par inhalation: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*

· **Effet primaire d'irritation:**
· Corrosion cutanée / irritation cutanée: *Provoque des brûlures de la peau et des lésions oculaires graves.*
· Lésions occulaires graves / irritation occulaire *Provoque des lésions oculaires graves.*

· **Sensibilisation:**
· Sensibilisation respiratoire ou cutanée: *Pas d'effet sensibilisant connu.*

· **Toxicité spécifique pour certains organes cibles (STOT):**
· après une exposition répétéé: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*
· après une exposition unique: *Peut irriter les voies respiratoires.*
· **Toxicité par aspiration:** *Pas d'effet.*

· **Effets CMR (cancérogène, mutagène et toxique pour la reproduction):**
· Cancérogénicité: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*

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· Mutagénicité sur les cellules germinales: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*
· Toxique pour la reproduction: *Les données disponibles indiquent que les critères de classification ne sont pas remplis*

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12 Informations écologiques

· ***Toxicité***

· Toxicité aquatique:	
1336-21-6 ammoniaque	
CE50 (ecologique)	*2700 (ALGUES) (mg/l)*
	110 (DAPHNIES) (mg/l, 48h)
LC50 (ecologique)	*0,89 (POISSONS) (mg/l, 96h)*
	Oncorhynchus mykiss

· ***Persistance et dégradabilité***

1336-21-6 ammoniaque	
Biodegradabilité	*(-)*
	Facilement Biodégradable. Entre dans le cycle biogéochimique de l'azote par suite de l'action des bactéries nitrifiantes de l'eau et du sol.

· ***Comportement dans les compartiments de l'environnement:***
· Potentiel de bioaccumulation *Le produit ne devrait pas s'accumuler dans les organismes vivants*
Le produit se dissout rapidement dans l'eau
· Mobilité dans le sol *Pas d'autres informations importantes disponibles.*
L'ion NH4+ est adsorbé par les particules du sol.

· ***Autres indications écologiques:***
· Valeur DCO: *Information non disponible*
· Valeur DBO5: *Information non disponible*
· Indications générales: *Ne pas laisser pénétrer dans la nappe phréatique, les eaux ou les canalisations.*
Ne doit pas pénétrer à l'état non dilué ou non neutralisé dans les eaux usées ou le collecteur.

· ***Résultats des évaluations PBT et VPVB***
· PBT: *Le produit ne possède pas de propriétés PBT telles que définies à l'annexe XIII du règlement (CE) n°1907/2006.*
· vPvB: *Le produit ne possède pas de propriétés vPvB telles que définies à l'annexe XIII du règlement (CE) n°1907/2006.*

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13 Considérations relatives à l'élimination

· ***Méthodes de traitement des déchets***
· Recommandation: *Ne doit pas être évacué avec les ordures ménagères. Ne pas laisser pénétrer dans les égouts.*
Doit faire l'objet d'un traitement spécial conformément aux prescriptions légales.
Pour la manipulation des déchets, prendre les précautions définies aux chapitres 7 et 8.
Réutilisation ou recyclage lorsque c'est possible, sinon incinération selon les méthodes recommandées d'élimination.
· Code déchet: *annexe II de l'article R 541-8 du Code de l'environnement*
Des données concernant l'utilisation par le consommateur sont nécéssaires pour déterminer le code déchet.

· ***Emballages non nettoyés:***
· Recommandation: *Les emballages ne pouvant pas être nettoyés doivent être évacués de la même manière que le produit.*
Les emballages vides peuvent contenir des résidus dangereux.
Ne pas retirer l'étiquette de l'emballage tant qu'il n'est pas nettoyé.
Ne pas traiter l'emballage vide comme un déchets ménager.
Ne pas incinérer un emballage fermé.

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14 Informations relatives au transport

· ***Transport par terre ADR/RID et RTMDR/RTMDF (ordonnance sur le transport de produits dangereux - route et train) (transfrontalier/domestique):***

· Classe ADR/RID-RTMDR/F (ordonnance sur le transport de produits dangereux - route et train): *8 (C5) Matières corrosives.*
· Indice Kemler: *80*
· No ONU: *2672*
· Groupe d'emballage: *III*
· Etiquette de danger *8*
· Nom d'expédition des Nations unies: *2672 AMMONIAC EN SOLUTION*
· Quantités limitées (LQ) *5L*
· Catégorie de transport *3*

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· Code de restriction en tunnels	E

· ***Transport maritime IMDG (ordonnance sur le transport de produits dangereux):***

· Classe IMDG:	8
· No ONU:	2672
· Label	8
· Groupe d'emballage:	III
· No EMS:	F-A,S-B
· Désignation technique exacte:	AMMONIA SOLUTION

· ***Transport aérien ICAO-TI et IATA-DGR:***

· Classe ICAO/IATA:	8
· No ID ONU:	2672
· Label	8
· Groupe d'emballage:	III
· Désignation technique exacte:	AMMONIA SOLUTION

· ***"Règlement type" de l'ONU:*** UN2672, AC EN SOLUTION, 8, III

· ***Précautions particulières à prendre par l'utilisateur*** Attention: Matières corrosives.

· ***Transport en vrac conformément à l'annexe II de la convention Marpol 73/78 et au recueil IBC*** Non applicable.

*
15 Informations réglementaires

· ***Réglementations/législation particulières à la substance ou au mélange en matière de sécurité, de santé et d'environnement***

· Etiquetage selon le règlement (CE) n° 1272/2008: voir chapitre 2

· Indications sur les restrictions de travail: Respecter les réglementations nationales applicables (ICPE, Code du travail, Maladies professionnelles...)

· Substances extrêmement préoccupantes (SVHC) selon REACH, article 57: Néant

· ***Évaluation de la sécurité chimique:*** Une évaluation de la sécurité chimique a été réalisée.

*
16 Autres informations

Ces indications sont fondées sur l'état actuel de nos connaissances, mais ne constituent pas une garantie quant aux propriétés du produit et ne donnent pas lieu à un rapport juridique contractuel.
Pour la France, en cas d'intoxication,appelez le Centre Antipoison(de préférence de votre région)ou le SAMU (15)
Angers: 02 41 48 21 21 - Bordeaux: 05 56 96 40 80
Lille: 0 825 812 822 - Lyon: 04 72 11 69 11
Marseille: 04 91 75 25 25 - Nancy: 03 83 32 36 36
Paris: 01 40 05 48 48 - Rennes: 02 99 59 22 22
Strasbourg:03 88 37 37 37 - Toulouse: 05 61 77 74 47

· Texte intégrale des phrases R, S, H et P utilisées dans le document:
H314 Provoque des brûlures de la peau et des lésions oculaires graves.
H335 Peut irriter les voies respiratoires.
H400 Très toxique pour les organismes aquatiques.
R34 Provoque des brûlures.
R50 Très toxique pour les organismes aquatiques.

· Acronymes et abréviations:
ADR: Accord européen sur le transport des marchandises dangereuses par Route
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
IATA-DGR: Dangerous Goods Regulations by the "International Air Transport Association" (IATA)
ICAO: International Civil Aviation Organization
ICAO-TI: Technical Instructions by the "International Civil Aviation Organization" (ICAO)
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
DNEL: Derived No-Effect Level (REACH)
PNEC: Predicted No-Effect Concentration (REACH)
LC50: Lethal concentration, 50 percent

(suite page 8)

Fiche de données de sécurité

selon 1907/2006/CE, Article 31

Date d'impression : 30.05.2011 *Numéro de version 19* *Révision: 30.05.2011*

Nom du produit: ***AMMONIAQUE <25%***
AMMONIAQUE 20.5% ou Alcali 22°Be

(suite de la page 7)

LD50: Lethal dose, 50 percent

· * Données modifiées par rapport à la version précédente

FR

(suite page 9)

Fiche de données de sécurité

selon 1907/2006/CE, Article 31

Date d'impression : 30.05.2011 *Numéro de version 19* *Révision: 30.05.2011*

Nom du produit: ***AMMONIAQUE <25%***
AMMONIAQUE 20.5% ou Alcali 22°Be

(suite de la page 8)

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Annexe: Scénario d'exposition

· ***Désignation brève du scénario d'exposition*** *Voir annexe 1.*

AMMONIAQUE < 25 %

	Type de document	Titre	Mise-à-jour	Version	Page
1	Scénario d'Exposition	Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents	2010-12-01	1.0	13
2	Scénario d'Exposition	Wide-dispersive Professional Use of Anhydrous and Aqueous Ammonia	2010-12-01	1.0	43

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Annex to extended Safety Data Sheet (eSDS):

Downstream User Exposure Scenario for Ammonia

Exposure Scenario : Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

1	Exposure Scenario

Industrial end uses of anhydrous and aqueous Ammonia as processing aids, non –processing aids and auxiliary agents.

Processes Covered:

Environmental Releases

ERC4: Industrial uses of processing aids
ERC5: Industrial end use resulting in inclusion into or onto a matrix
ERC6b: Industrial end use of reactive processing aids
ERC 7: Industrial end use of substances in closed systems

Worker Processes

PROC01: Use in closed process, no likelihood of exposure.
PROC02: Use in closed, continuous process with occasional controlled exposure.
PROC03: Use in closed batch processes
PROC04: Use in batch and other processes where the potential for exposure occurs
PROC05: Mixing and blending
PROC07: Industrial spraying
PROC08a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.
PROC08b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.
PROC09: Transfer of formulations to small containers.
PROC10: Roller application or brushing of coatings
PROC13: Treatment of articles by dipping and pouring
PROC15: Laboratory use
PROC19: Low energy hand mixing

Anhydrous liquid and aqueous solutions of ammonia are used by a range of industry sectors in a broad number of applications. These include industrial end use as a reactive or non-reactive processing aid in continuous or batch processes, as an auxiliary agent or as substance in a closed system. Common industrial end-uses of ammonia are shown below.

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Common industrial end-uses of ammonia

Industrial end-use	Type of use					Description of use
	Processing aid	Non-processing aid	Reactive processing aid	Auxiliary agent	Use in closed system	
Use as developing agent in photochemical processes	X					Ammonia is used as a developing agent in photochemical processes such as white printing, blue printing and in the diazo duplication press.
Use of refrigerant systems		X			X	Anhydrous liquid ammonia is used as a refrigerant in household, commercial and industrial systems due to its high heat of vaporisation and relative ease of liquefaction.
Insulation products		X				
Inks and toners	X	X				Ammonia vapours are used as a reagent in treating writing or ink marks
Coatings, thinners, paint removers	X	X				
Processing aid in chemicals industry			X			
Use as an extraction agent			X			Ammonia is used as an extraction agent in the mining industry to extract metals like copper, nickel and molybdenum from their ores.
Treatment of gas (NOx and SOx reduction)			X		X	Ammonia is used in stack emission control systems to neutralise sulphur oxides from combustion of sulphur-containing fuels, as a method of NOx control in both catalytic and non-catalytic applications and to enhance the efficiency of electrostatic precipitators for particulate control.
Processing aid in nutrition			X		X	The food and beverage industry use ammonia as a source of nitrogen required for yeast and micro-organism
Use as neutralising agent			X		X	Ammonia is used by the petrochemical industry in neutralizing the acid constituents of crude oil and in the protection of equipment from corrosion
Textile dyes			X			
Treatment of water	X		X			Aqueous ammonia is used in water and waste-water treatment areas to control pH, to regenerate weak anion exchange resins and as an oxygen scavenger in boiled water treatment. In water disinfection, aqueous ammonia is added to water containing free chlorine to produce a chloramines disinfectant.
Use as washing and cleaning products	X		X			Weak ammonia solutions are used extensively within industry, by professionals and consumers as commercial and household cleaners and detergents cleaning products. Commercial ammonia cleaning products contain up to 30% ammonia whereas household products contain 5-10% ammonia
Treatment of textiles		X	X			Liquid ammonia is used to increase the quality of textiles
Treatment of pulp and paper		X	X			Ammonia is used in the pulp and paper industry to pulp wood and as a casein dispersant to coat paper.
Treatment of leather		X	X			The leather industry utilises ammonia as a curing agent,

						as a slime and mould preservative in tanning liquors and as a protective agent for leather and furs in storage
Treatment of wood	X		X			Anhydrous ammonia fumes are used to darken wood in a process called “ammonia fuming”
Treatment of metal surfaces	X		X			Ammonia is used in metal treatment processes such as nitriding, carbonitriding, bright annealing, furnace brazing, sintering, sodium hydride descaling, atomic hydrogen welding and other application where protective atmospheres are required.
Treatment of rubber/latex		X	X			Concentrated aqueous ammonia is used in the rubber industry as a preservative for natural and synthetic latex due to its antibacterial and alkaline properties and as a stabiliser to prevent pre-mature coagulation (e.g. “ammoniation” of natural rubber latex.
Manufacture of semiconductors/electronics				X		Ammonia is used in the electronics industry in the manufacturing of semiconductor chips.
Adhesives, sealants	X			X		
Polymer preparations	X			X		
Aircare products					X	
Preservatives		X				Ammonia is uses as a preservative for the storage of high moisture corn

Contributing Environmental Scenario: Environmental exposure arising due to Industrial end uses of anhydrous and aqueous ammonia.

Contributing Worker Scenarios: Worker exposure arising due to day to day use in closed processes with no likelihood of exposure, day to day use in closed continuous processes with occasional exposure (such as sampling), day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance), mixing and blending, transfer to small containers, transfer of substance to and from large vessels and containers, roller and brushing application of coatings, treatment of articles by dipping and pouring, laboratory use, hand mixing and industrial spraying.

2.1 Contributing scenario 1 controlling environmental exposure for ES 4

Environmental exposure arising due to industrial end uses of anhydrous and aqueous ammonia.

Section 2.1 describes the environmental releases that may occur during the industrial end uses of anhydrous and aqueous ammonia. These releases may occur due to emission to wastewater or through emission to the atmosphere. If emission to wastewater occurs on-site treatment in an industrial waste water treatment plant will be required in order to remove downstream emissions to the environment.

In reality removal of ammonia in sewage treatment plants is highly efficient being removed first by nitrification to nitrate followed by denitrification resulting in the release of nitrogen gas. It is considered that if there processes are employed complete removal from the wastewater stream will occur. Emissions to the atmosphere should not exceed concentrations of 30.5 mg/m^3.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.
Frequency and duration of use
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Possible exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.
Environmental factors influenced by risk management
Flow rate of receiving water at least 18,000 m^3 per day. Dilution of any STP emissions at least 10 fold.
Other operational conditions affecting environmental exposure
Workers are fully trained in safe use and the use of appropriate systems in order to prevent accidental release. Closed systems are employed in order to prevent un-intended emissions.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed sealed. On site WWTPs should be available at industrial sites in order to eliminate emissions to the environment via contaminated wastewater.
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
Waste water should be emitted to the on-site industrial WWTP for specialized removal. Emissions to air from the industrial processes or from the onsite WWTP should not exceed a total concentration of 19.9 mg/m^3 of air. This is approximately equivalent to a total loss to air of 70,000 kg/day. Sludge from the on-site WWTP should not be spread to soil. Any solid waste will be sent as waste for landfill, incineration or recycling.
Organizational measures to prevent/limit releases from site
Workers are fully trained in order to prevent accidental release and exposures may be monitored to ensure airborne concentrations are within acceptable levels.
Conditions and measures related to municipal STP
Direct emissions to the municipal STP should not be made.
Conditions and measures related to external treatment of waste for disposal
Residues may be sent to external waste treatment, on-site effluent treatment or recycled back into the industrial process. Sludge from the onsite WWTP should be recycled, incinerated or sent to landfill.
Conditions and measures related to external recovery of waste
There is no envisaged external recovery of waste. Waste sludge is reduced and then incinerated and emissions to air are not collected.

2.2	**Contributing scenario 2 controlling worker exposure day to day use in closed processes with no likelihood of exposure.**

Worker exposure arising due to day to day use in closed processes with no likelihood of exposure during the industrial end use processes.
Section 2.2 describes the potential exposure to workers during the industrial end use of ammonia as an intermediate from operation of closed systems. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.3	**Contributing scenario 3 controlling worker exposure due to day to day use in closed continuous processes with occasional exposure (such as sampling)**

Worker exposure arising due to day to day use in closed continuous processes with occasional exposure (such as sampling).
Section 2.3 describes the potential exposure to workers during the industrial end use of preparations of ammonia from the operation of closed systems with the potential for occasional exposure during tasks such as sampling, cleaning and maintenance. The potential exposure arises from the operation of industrial end use equipment and its associated machinery and during routine sampling, cleaning and occasional maintenance. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in these tasks. Formulated solutions are stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia).

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.4	Contributing scenario 4 controlling worker exposure for day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance)

Worker exposure arising due to day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance).

Section 2.4 describes the potential exposure to workers during day to day use of industrial machinery, pipelines and storage vessels. Potential exposure may occur during the day to day use however it is more likely to occur during tasks associated with the batch or other processes themselves such as sampling of produced intermediates, cleaning and routine maintenance.

Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Solutions of ammonia are stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia).

This contributing considers the potential exposures from batch and other processes (such as one off exposures) and though there is some potential for exposure generally systems are in place to control and losses or unintended emissions of ammonia at the industrial facility.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Industrial end use sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use during batch and other processes is generally a short duration task, with limited potential for exposure occurring in reality.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.5	**Contributing scenario 5 controlling worker exposure for mixing and blending**

Worker exposure arising due to mixing and blending in batch processes during industrial end use

Section 2.5 describes the potential exposure to workers during mixing and blending of ammonia formulations. Potential exposure may occur during the day to day use of machinery and technologies associated with the blending and mixing process as part of the overall industrial end use of ammonia.

Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Stock ammonia is stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia).

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.

Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.6	Contributing scenario 6 controlling worker exposure for transfer to small containers

Worker exposure arising due to transfer to small containers in a dedicated filling line.
Section 2.6 describes the potential exposure to workers during the filling of small containers in dedicated filling lines. Potential exposure is most likely to occur during tasks associated with the actual filling of the containers themselves. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Formulated liquid ammonia is then stored and transported as a liquid in the small sized containers.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.7	**Contributing scenario 7 controlling worker exposure for transfer to and from large containers and vessels**

Worker exposure arising due transfer of ammonia to and from large containers and vessels
Section 2.7 describes the potential exposure to workers during the filling and loading to/from large vessels and containers in dedicated and non-dedicated filling lines. Potential exposure is most likely to occur during tasks associated with the actual filling of the containers and vessels themselves. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Formulated liquid ammonia is then stored and transported as a liquid in the small sized containers.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.
Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial end use is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with industrial end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Industrial end-uses of anhydrous and aqueous forms of ammonia involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.8	**Contributing scenario 8 controlling worker exposure for roller and brushing applications of coatings**

Worker exposure arising due to roller and brushing applications of coatings

Section 2.8 describes the potential exposure to workers during the industrial end use of ammonia during roller and brushing applications to surfaces of coatings of ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Amounts used
Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial brushing and roller applications is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place. Workers should not be directly exposed to the application solutions.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with industrial intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Industrial end-uses of surface applied ammonia during roller and brushing applications involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.9	**Contributing scenario 9 controlling worker exposure for treatment of articles by dipping and pouring**

Worker exposure arising due to treatment of articles by dipping and pouring.
Section 2.9 describes the potential exposure to workers during the industrial end use of ammonia during dipping and pouring treatment of articles using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in

place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial treatment of articles by dipping and pouring is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place. Workers should not be directly exposed to the article treatment solutions.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with industrial intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Industrial end-uses of surface applied ammonia during roller and brushing applications involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). All operations are performed in a closed system. Pipelines and vessels are sealed and insulated and sampling is carried out with a closed sample loop. Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.10	Contributing scenario 10 controlling worker exposure for laboratory use

Worker exposure arising due to laboratory use of ammonia (small scale non-industrial laboratories).

Section 2.10 describes the potential exposure to workers during laboratory use of ammonia especially during the filling and loading of small flasks and vessels using non-dedicated filling lines or small scale transfer methods. Potential exposure is most likely to occur during tasks associated with the actual transfer or mixing of the ammonia solutions.

For dedicated small scale laboratories appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable.

During laboratory use of ammonia solutions of aqueous ammonia in the 5 – 25% concentrations range are most liklety to be encountered. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable. It is this aqueous ammonia that is most likely to cause potential exposure for this contributing scenario.

Amounts used

Amounts use in a non-industrial setting are likely to be small with less than 1 litre or 1 kilogram present on site. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330 however actual emission of ammonia is likely to be much less frequent in practice.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Again use of ammonia is not likely to be this frequent in practice.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

During the laboratory end use of ammonia indoors local exhaust ventilation may be in place. Personal protective equipment is also used to minimize the potential for dermal exposure during the transfer process. RPE is provided when required.

Technical conditions and measures at process level (source) to prevent release

During laboratory use LEV may or may not be in place (refer to section 3 below for relevant exposure levels for these cases). All technological devices should have a proper quality certification, and should be regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not considered sufficient or in enclosed areas.

Organizational measures to prevent/limit release

Laboratory workers are fully trained in safe use of chemicals in general and in the use of appropriate PPE in order to prevent accidental release or exposure.

Conditions and measures related to personal protection, hygiene and health.

Workers may potentially be exposed to ammonia during laboratory use when filling containers and vessels or during transfer. Extract ventilation is provided at openings and points were emissions may occur.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers are well-trained in the required procedures and the use of appropriate protective equipment.

Where good natural ventilation is found to be inadequate, mechanical (general) ventilation or local exhaust ventilation (LEV) is provided. Personal protective clothing (e.g. face/eye/ear protection, helmet, gloves boots and protective overall) is worn

when any potential contact may arise.

Level A clothing (full encapsulating suit with self contained breathing apparatus) is used when handling large liquid spills or vapour clouds. Impervious clothing and rubber gloves are used for small liquid spills and normal loading and unloading operations. Safety shower/eye wash facilities are provided at sites which handle or store ammonia. Filtering respiratory masks are worn in case on the accidental release of ammonia.

2.11	**Contributing scenario 11 controlling worker exposure for hand mixing with intimate contact and PPE only**

Worker exposure arising due to hand mixing with intimate contact and PPE only.

Section 2.11 describes the potential exposure to workers during the industrial end use of ammonia during hand mixing of formulations (with intimate contact and PPE only) using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia hand mixing in this case considered intimate contact and suitable PPE only.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Workers should not be directly exposed to the mixing solutions without PPE in place. LEV is generally not required.

Technical conditions to control dispersion from source towards worker

No specific measures aside from good industrial practice is required.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of mixing equipment and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Industrial hand mixing of ammonia would generally be carried out indoors using low energy methods and in vessels which should reduce the potential for un-intended loss. The potential for industrial workers to be exposed to ammonia during these processes is therefore negligible since PPE and low emission methods are used.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the hand mixing of ammonia or ammonia solutions are well-trained in the required procedures and use of appropriate protective equipment.

2.12	Contributing scenario 12 controlling worker exposure for industrial spraying

Worker exposure arising due to industrial spraying and air dispersive techniques

Section 2.12 describes the potential exposure to workers during the industrial end use of ammonia for spray aplications using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Industrial sites may use up to a largest individual site tonnage of 25,000 tonnes per annum, with up to 354,000 tonnes used per year in the European Union. According to the guidance for this tonnage band, the default REACH number of emission days per year are 330.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during industrial spraying is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects is conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place. Workers should not be directly exposed to the article treatment solutions.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with industrial intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects is conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Industrial end-uses of sprayed ammonia during air dispersive applications involve special equipment and high integrity specialized systems.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps or tanks etc). Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the industrial end use of ammonia are well-trained in the required procedures and use of appropriate

protective equipment.

3	Exposure estimation and reference to its source

The assessment of worker exposure to anhydrous and aqueous forms of ammonia in industrial end-use applications (ES 4) was carried out for processes relevant to this scenario as identified by PROC codes reflecting: use and storage of ammonia in closed systems with no likelihood of exposure (PROC 1), use in closed, continuous processes with occasional controlled exposure (PROC 2), formulation using closed batch processes (PROC 3), use in batch or other processes (PROC 4), mixing or blending in a batch process (PROC 5), industrial spraying (PROC 7), maintenance and clean down (PROC 8a), transfer (PROC 8b), transfer of ammonia into containers (PROC 9), brush and roller applications (PROC 10), treatment of articles by dipping and pouring (PROC 13), and analysis of samples (PROC 15) and hand-mixing (PROC 19).

A screening-level (Tier 1) assessment of worker exposure was carried out using the ECETOC Targeted Risk Assessment (TRA) model. The ECETOC TRA was used to predict dermal exposures (expressed as a daily systemic dose in mg/kg bw) and inhalation exposure concentrations (expressed as an airborne concentration in mg/m3) associated with each process defined by PROC codes.

Exposure to workers was assessed taking into account different operational conditions that may be associated with the industrial end-use of ammonia and the impact of different exposure control measures. Exposures were determined for task durations of 1- 4 hours or >4 hours and assuming that process are carried out either outdoors, indoors without use of local exhaust ventilation (LEV) or indoors with the use of LEV. To reflect the use of personal protective equipment (PPE), dermal exposures were determined assuming either no gloves or gloves affording 90% protection of the hands are worn. To reflect the use of respiratory protective equipment (RPE), inhalation exposure concentrations were determined assuming either no RPE or RPE affording 95% protection is worn.

The ECETOC TRA model uses a simple algorithm to determine dermal exposures that does not take the physical-chemical properties of a substance into account. The same dermal exposure where therefore predicted for anhydrous and aqueous forms of ammonia. Parameters used in the ECETOC TRA model to assess inhalation exposures were: molecular weight (35 $g.mol^{-1}$ and 17 $g.mol^{-1}$ for aqueous and anhydrous forms respectively) and vapour pressure (the vapour pressure of anhydrous forms of ammonia is 8.6 x 10^5 Pa at 20^{o}C, whereas the vapour pressure of aqueous ammonia solution between 5 and 25% w/w ranges from 5 x 10^3 Pa to 4 x10^4 Pa at 20^{o}C. Systemic dermal exposures have been determined for a worker with bodyweight 70 kg.

For environmental emissions complete removal in the on-site WWTP was considered during derivation of the values below. Emission values and environmental concentrations were calculated using the EUSES 2.1 model.

Information for contributing scenario 1 (environmental exposure):

The following PEC values were calculated using EUSES 2.1

ERC	PEC	Values
ERCs 4, 5, 6b and 7	PEC in sewage effluent	0 (due to complete removal)
ERCs 4, 5, 6b and 7	PEC in aquatic compartment (mg/L): Freshwater	ERC 4: 2.82 x 10^{-3} ERC 5: 1.46 x 10^{-3} ERC 6b: 4.54 x 10^{-5} ERC 7: 1.46x 10^{-4}
	Marine Water	ERC 4: 6.06 x 10^{-4} ERC 5: 3.17 x 10^{-4} ERC 6b: 5.19 x 10^{-6} ERC 7: 3.17 x 10^{-5}

	ERC 5 Freshwater (Tier 2)	1.46x 10^{-3} mg/L (Total Ammonia) 5.58 x 10^{-5} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	0.051	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)
	ERC 5 Marine water (Tier 2)	3.17 x 10^{-4} mg/L (Total Ammonia) 1.21 x 10^{-5} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	0.011	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)
	ERC 6b Freshwater (Tier 2)	4.54 x 10^{-5} mg/L (Total Ammonia) 1.73 x 10^{-6} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	1.58 x 10^{-3}	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)
	ERC 6b Marine water (Tier 2)	5.19 x 10^{-6} mg/L (Total Ammonia) 1.98 x 10^{-7} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	1.80 x 10^{-4}	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)
	ERC 7 Freshwater (Tier 2)	1.46 x 10^{-4} mg/L (Total Ammonia) 5.58 x 10^{-6} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	5.07 x 10^{-3}	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)
	ERC 7 Marine water (Tier 2)	3.17 x 10^{-5} mg/L (Total Ammonia) 1.21 x 10^{-6} mg/L (Free Ammonia)	0.0011 mg/l (Free Ammonia)	1.10 x 10^{-3}	Conversion from Total Ammonia to Free Ammonia based on a fraction of 3.82% given for pH 8 and 25C. (Ref data tabulated in EPA document EPA-600/3-79-091)

The following values were obtained using ECETOC TRA for worker exposure

Dermal exposures predicted using the ECETOC TRA model

Description of activity	**PROC**	**Exposure assumptions**	**Estimated Exposure mg/kg bw/d**

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

		Duration	Use of ventilation	No gloves worn	Gloves worn (90% reduction)
Information for contributing scenario 2:					
Use in a closed process, no likelihood of exposure: storage (closed or bulk container)	PROC 1	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03
Information for contributing scenario 3:					
Use in a closed, continuous process with occasional controlled exposure (e.g. sampling)	PROC 2	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	1.37	0.14
			Indoors with LEV	0.14	0.01
Information for contributing scenario 4:					
Use in closed batch process (synthesis or formulation)	PROC 3	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03
		1-4 hrs or >4 hrs	Indoors with LEV	0.03	<0.01
Use in batch process (synthesis) where opportunity for exposure arises	PROC 4	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 5:					
Mixing or blending in batch process	PROC 5	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
		1-4 hrs or >4 hrs	Indoors with LEV	0.07	0.01
Information for contributing scenario 6:					
Transfer into small containers	PROC 9	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 7:					
Transfer (charging/discharging) from or to vessels or large containers at non-dedicated facilities	PROC 8a	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
			Indoors with LEV	0.14	0.01
Transfer (charging/discharging) from or to vessels or large containers at dedicated facilities	PROC 8b	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
			Indoors with LEV	0.69	0.07
Information for contributing scenario 8:					
Roller application or brushing	PROC 10	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	27.43	0.14
		1-4 hrs or >4 hrs	Indoors with LEV	1.37	10.71

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Information for contributing scenario 9:					
Treatment of articles by dipping and pouring	PROC 13	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 10:					
Laboratory use : Quality control in a laboratory	PROC 15	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03
		1-4 hrs or >4 hrs	Indoors with LEV	0.03	<0.01
Information for contributing scenario 11:					
Hand-mixing with intimate contact and PPE only	PROC 19	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	141.73	14.13
Information for contributing scenario 12:					
Industrial spraying	PROC 7	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	42.86	4.29
		1-4 hrs or >4 hrs	Indoors with LEV	2.14	0.21

Inhalation exposure concentrations predicted using the ECETOC TRA model

				Anhydrous ammonia		**Aqueous ammonia (5-25% w/w)**	
Description of activity	**PROC**	**Exposure assumptions**		**Estimated Exposure Concentration mg/m3**			
		Duration	**Use of ventilation**	**No RPE**	**RPE (95% reduction)**	**No RPE**	**RPE (95% reduction)**
Information for contributing scenario 2:							
Used in a closed process, no likelihood of exposure: Storage (closed bulk or container)	PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	0.01	NA
		1-4 hrs or >4 hrs	Indoors without LEV	0.01	NA	0.01	NA
Information for contributing scenario 3:							
Use in a closed, continuous process with occasional controlled exposure (e.g. sampling)	PROC 2	>4hrs	Outdoors	24.79	1.24	30.63	1.53
		>4hrs	Indoors without LEV	35.42	1.77	43.75	2.19
		>4hrs	Indoors with LEV	3.53	0.18	4.38	0.22
		1-4 hrs	Outdoors	14.88	0.74	18.38	0.92
		1-4 hrs	Indoors without LEV	22.25	1.06	26.25	1.31
		1-4 hrs	Indoors with LEV	2.13	0.11	2.63	0.13
Information for contributing scenario 4:							
Use in closed batch process (synthesis or formulation)	PROC 3	>4hrs	Outdoors	49.58	2.48	61.25	3.06
		>4hrs	Indoors without LEV	70.83	3.54	87.5	4.38
		>4hrs	Indoors with LEV	7.08	0.35	8.75	0.44

		1-4 hrs	Outdoors	29.75	1.49	36.75	1.84
		1-4 hrs	Indoors without LEV	42.5	2.13	52.50	2.63
		1-4 hrs	Indoors with LEV	4.25	0.21	5.25	0.26
Use in batch process (synthesis) where opportunity for exposure arises	PROC 4	>4hrs	Outdoors	49.58	2.48	61.25	3.06
		>4hrs	Indoors without LEV	70.83	3.54	87.5	4.38
		>4hrs	Indoors with LEV	7.08	0.35	8.75	0.44
		1-4 hrs	Outdoors	29.75	1.49	36.75	1.84
		1-4 hrs	Indoors without LEV	42.5	2.13	52.5	2.63
		1-4 hrs	Indoors with LEV	4.25	0.21	5.25	0.26
Information for contributing scenario 5:							
Mixing or blending in batch process	PROC 5	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Information for contributing scenario 6:							
Maintenance, clean down	PROC 8a	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Transfer of ammonia (charging/discharging) from/to vessels or large containers at dedicated facilities	PROC 8b	>4hrs	Outdoors	74.38	3.72	91.88	4.59
		>4hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		>4hrs	Indoors with LEV	3.19	0.16	3.94	0.20
		1-4 hrs	Outdoors	44.63	2.23	55.13	2.76
		1-4 hrs	Indoors without LEV	63.75	3.19	78.75	3.94
		1-4 hrs	Indoors with LEV	1.91	0.1	2.36	0.12
Information for contributing scenario 7:							
Transfer into small containers	PROC 9	>4hrs	Outdoors	99.17	4.96	122.50	6.13
		>4hrs	Indoors without LEV	141.67	7.08	175.00	8.75
		>4hrs	Indoors with LEV	14.17	0.71	17.50	0.88
		1-4 hrs	Outdoors	59.50	2.98	73.50	3.68
		1-4 hrs	Indoors without LEV	85.00	4.25	105.00	5.25
		1-4 hrs	Indoors with LEV	8.5	0.43	10.50	0.53
Information for contributing scenario 8:							
Roller application or	PROC	>4hrs	Outdoors	NA	NA	153.13	7.66

brushing	10	>4hrs	Indoors without LEV	NA	NA	218.75	10.94
		>4hrs	Indoors with LEV	NA	NA	21.88	1.09
		1-4 hrs	Outdoors	NA	NA	91.88	4.59
		1-4 hrs	Indoors without LEV	NA	NA	131.25	6.56
		>4hrs	Outdoors	NA	NA	13.13	0.66
Information for contributing scenario 9:							
Treatment of articles by dipping and pouring	PROC 13	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Information for contributing scenario 10:							
Quality control in a laboratory	PROC 15	>4hrs	Indoors without LEV	35.42	1.77	43.75	2.19
		>4hrs	Indoors with LEV	3.54	0.18	4.38	0.22
		1-4 hrs	Indoors without LEV	21.25	1.06	26.25	1.31
		1-4 hrs	Indoors with LEV	2.13	0.11	2.63	0.13
Information for contributing scenario 11:							
Hand-mixing with intimate contact and PPE only	PROC 19	<4 hrs	Outdoors	NA	NA	153.13	7.66
		<4 hrs	Indoors without LEV	NA	NA	218.75	10.94
		1-4 hrs	Outdoors	NA	NA	91.88	4.59
		1-4 hrs	Indoors without LEV	NA	NA	131.25	6.56
Information for contributing scenario 12:							
Industrial spraying	PROC 7	>4hrs	Outdoors	NA	NA	306.25	15.31
		>4hrs	Indoors without LEV	NA	NA	437.5	21.88
		>4hrs	Indoors with LEV	NA	NA	21.88	1.09
		1-4 hrs	Outdoors	NA	NA	183.75	9.19
		1-4 hrs	Indoors without LEV	NA	NA	262.5	13.13
		1-4 hrs	Indoors with LEV	NA	NA	13.13	0.66

The following RCR values were obtained using ECETOC TRA and the relevant DNELs

Quantitative risk characterisation of dermal exposures to anhydrous or aqueous (in preparations of 5- 25 % w/w) ammonia for industrial workers (ES 4 – Industrial end-use)

PROC code	**Exposure assumptions**	**ES 4- exposure concentrations (EC) mg/kg bw/d**	**Acute / long term systemic effects** **DNEL = 6.8 mg/kg bw/d**
			Risk characterisation ratio

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

	Duration	Use of ventilation	No gloves worn	Gloves worn (90% reduction)	No gloves worn	Gloves worn (90% reduction)
Information for contributing scenario 2:						
PROC 1	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03	0.05	0.01
Information for contributing scenario 3:						
PROC 2	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	1.37	0.14	0.20	0.02
		Indoors with LEV	0.14	0.01	0.02	<0.01
Information for contributing scenario 4:						
PROC 3	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03	0.05	0.01
		Indoors with LEV	0.03	<0.01	0.01	<0.01
PROC 4	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 5:						
PROC 5	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.07	0.01	0.01	<0.01
Information for contributing scenario 6:						
PROC 8a	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.14	0.01	0.02	<0.01
PROC 8b	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 7:						
PROC 9	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 8:						
PROC 10	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	27.43	2.74	4.03	0.40
		Indoors with LEV	1.37	0.14	0.20	0.02
Information for contributing scenario 9:						
PROC 13	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 10:						
PROC 15	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03	0.05	0.01
		Indoors with LEV	0.03	<0.01	0.01	<0.01

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

Information for contributing scenario 11:						
PROC 19	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	141.73	14.14	20.80	2.08*
*Adjusting for 10% dermal absorption gives a dermal exposure of 1.41 mg/kg bw/d assuming gloves affording 90% protection are worn and the RCR = 0.2						
Information for contributing scenario 12:						
PROC 7	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	42.86	4.29	6.30	0.63
		Indoors with LEV	2.14	0.21	0.32	0.03

Quantitative risk characterisation of inhalation exposure concentrations of anhydrous ammonia for industrial workers (ES 4 – Industrial end-use)

PROC code	**Exposure assumptions**		**ES 4-exposure concentrations (EC) mg/m^3**		**Acute / long-term systemic effects** **DNEL = 47.6 mg/m3**		**Acute-local effects** **DNEL = 36 mg/m3**		**Long-term local effects** **DNEL = 14 mg/m3**	
					RCR		**RCR**		**RCR**	
	Duration	**Use of ventilation**	**No RPE**	**RPE -95% reduction**	**No RPE**	**RPE – 95% reduction**	**No RPE**	**RPE 95% reduction**	**No RPE**	**RPE -95% reduction**
Information for contributing scenario 2:										
PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	<0.01	NA	<0.01	NA	<0.01	NA
		Indoors without LEV	0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA
Information for contributing scenario 3:										
PROC 2	>4hrs	Outdoors	24.79	1.24	0.52	0.03	0.69	0.03	1.77	0.09
		Indoors without LEV	35.42	1.77	0.74	0.04	0.98	0.05	2.53	0.13
		Indoors with LEV	3.54	0.18	0.07	0.00	0.10	<0.01	0.25	0.01
	1-4 hrs	Outdoors	14.88	0.74	0.31	0.02	0.41	0.02	1.06	0.05
		Indoors without LEV	22.25	1.06	0.47	0.02	0.59	0.03	1.52	0.08
		Indoors with LEV	2.13	0.11	0.04	0.00	0.06	<0.01	0.15	0.01
Information for contributing scenario 4:										
PROC 3	>4hrs	Outdoors	49.58	2.48	1.04	0.05	1.38	0.07	3.54	0.18
		Indoors without LEV	70.83	3.54	1.49	0.07	1.97	0.10	5.06	0.25
		Indoors with LEV	7.08	0.35	0.15	0.01	0.20	0.01	0.51	0.03
	1-4 hrs	Outdoors	29.75	1.49	0.63	0.03	0.83	0.04	2.13	0.11
		Indoors without LEV	42.5	2.13	0.89	0.04	1.18	0.06	3.04	0.15
		Indoors with LEV	4.25	0.21	0.09	0.00	0.12	0.01	0.30	0.02
PROC	>4hrs	Outdoors	49.58	2.48	1.04	0.05	1.38	0.07	3.54	0.18

4		Indoors without LEV	70.83	3.54	1.49	0.07	1.97	0.10	5.06	0.25
		Indoors with LEV	7.08	0.35	0.15	0.01	0.20	0.01	0.51	0.03
	1-4 hrs	Outdoors	29.75	1.49	0.63	0.03	0.83	0.04	2.13	0.11
		Indoors without LEV	42.5	2.13	0.89	0.04	1.18	0.06	3.04	0.15
		Indoors with LEV	4.25	0.21	0.09	0.00	0.12	0.01	0.30	0.02
Information for contributing scenario 5:										
PROC 5	>4hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44
		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
Information for contributing scenario 6:										
PROC 8a	>4hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44
		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
PROC 8b	>4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	3.19	0.16	0.07	0.00	0.09	<0.01	0.23	0.01
	1-4 hrs	Outdoors	44.63	2.23	0.94	0.05	1.24	0.06	3.19	0.16
		Indoors without LEV	63.75	3.19	1.34	0.07	1.77	0.09	4.55	0.23
		Indoors with LEV	1.91	0.10	0.04	0.00	0.05	<0.01	0.14	0.01
Information for contributing scenario 7:										
PROC 9	>4 hrs	Outdoors	99.17	4.96	2.08	0.10	2.75	0.14	7.08	0.35
		Indoors without LEV	141.67	7.08	2.98	0.15	3.94	0.20	10.12	0.51
		Indoors with LEV	14.17	0.71	0.30	0.01	0.39	0.02	1.01	0.05
	1-4 hrs	Outdoors	59.50	2.98	1.25	0.06	1.65	0.08	4.25	0.21
		Indoors without LEV	85.00	4.25	1.79	0.09	2.36	0.12	6.07	0.30
		Indoors with LEV	8.5	0.43	0.18	0.01	0.24	0.01	0.61	0.03
Information for contributing scenario 9:										
PROC 13	>4 hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44

13		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
Information for contributing scenario 10:										
PROC 15	>4 hrs	Indoors without LEV	35.42	1.77	0.74	0.04	0.98	0.05	2.53	0.13
		Indoors with LEV	3.54	0.18	0.07	0.00	0.10	<0.01	0.25	0.01
	1-4 hrs	Indoors without LEV	21.25	1.06	0.45	0.02	0.59	0.03	1.52	0.08
		Indoors with LEV	2.13	0.11	0.04	0.00	0.06	<0.01	0.15	0.01

Quantitative risk characterisation of inhalation exposure concentrations of aqueous ammonia (in preparations of 5-25% w/w) in industrial workers (ES 4 – Industrial end-use)

PROC code	**Exposure assumptions**		**ES 4- exposure concentrations (EC) mg/m³**		**Acute /long-term systemic effects DNEL = 47.6 mg/m3**		**Acute – local effects DNEL = 36 mg/m3**		**Long-term local effects DNEL = 14 mg/m3**	
					RCR		**RCR**		**RCR**	
	Duration	**Use of ventilation**	**No RPE**	**RPE (95% reduction)**	**No RPE**	**RPE - 95% reduction**	**No RPE**	**RPE -95% reduction**	**No RPE**	**RPE -95% reduction**
Information for contributing scenario 2:										
PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	<0.01	NA	<0.01	NA	<0.01	NA
		Indoors without LEV	0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA
Information for contributing scenario 3:										
PROC 2	>4hrs	Outdoors	30.63	1.53	0.64	0.03	0.85	0.04	2.19	0.11
		Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	4.38	0.22	0.09	0.00	0.12	0.01	0.31	0.02
	1-4 hrs	Outdoors	18.38	0.92	0.39	0.02	0.51	0.03	1.31	0.07
		Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	2.63	0.13	0.06	0.00	0.07	<0.01	0.19	0.01
Information for contributing scenario 4:										
PROC 3	>4hrs	Outdoors	61.25	3.06	1.29	0.06	1.70	0.09	4.38	0.22
		Indoors without LEV	87.5	4.38	1.84	0.09	2.43	0.12	6.25	0.31

		Indoors with LEV	8.75	0.44	0.18	0.01	0.24	0.01	0.63	0.03
	1-4 hrs	Outdoors	36.75	1.84	0.77	0.04	1.02	0.05	2.63	0.13
		Indoors without LEV	52.50	2.63	1.10	0.06	1.46	0.07	3.75	0.19
		Indoors with LEV	5.25	0.26	0.11	0.01	0.15	0.01	0.38	0.02
PROC 4	>4hrs	Outdoors	61.25	3.06	1.29	0.06	1.70	0.09	4.38	0.22
		Indoors without LEV	87.5	4.38	1.84	0.09	2.43	0.12	6.25	0.31
		Indoors with LEV	8.75	0.44	0.18	0.01	0.24	0.01	0.63	0.03
	1-4 hrs	Outdoors	36.75	1.84	0.77	0.04	1.02	0.05	2.63	0.13
		Indoors without LEV	52.5	2.63	1.10	0.06	1.46	0.07	3.75	0.19
		Indoors with LEV	5.25	0.26	0.11	0.01	0.15	0.01	0.38	0.02
Information for contributing scenario 5:										
PROC 5	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 6:										
PROC 8a	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
PROC 8b	>4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	3.94	0.20	0.08	0.00	0.11	0.01	0.28	0.01
	1-4 hrs	Outdoors	55.13	2.76	1.16	0.06	1.53	0.08	3.94	0.20
		Indoors without LEV	78.75	3.94	1.65	0.08	2.19	0.11	5.63	0.28
		Indoors with LEV	2.36	0.12	0.05	0.00	0.07	<0.01	0.17	0.01
Information for contributing scenario 7:										

Ammonia– Industrial End-use of anhydrous and aqueous Ammonia as processing aids, non-processing aids and auxiliary agents

PROC 9	>4hrs	Outdoors	122.50	6.13	2.57	0.13	3.40	0.17	8.75	0.44
		Indoors without LEV	175.00	8.75	3.68	0.18	4.86	0.24	12.50	0.63
		Indoors with LEV	17.50	0.88	0.37	0.02	0.49	0.02	1.25	0.06
	1-4 hrs	Outdoors	73.50	3.68	1.54	0.08	2.04	0.10	5.25	0.26
		Indoors without LEV	105.00	5.25	2.21	0.11	2.92	0.15	7.50	0.38
		Indoors with LEV	10.50	0.53	0.22	0.01	0.29	0.01	0.75	0.04
Information for contributing scenario 8:										
PROC 10	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 9:										
PROC 13	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 10:										
PROC 15	>4 hrs	Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	4.38	0.22	0.09	0.00	0.12	0.01	0.31	0.02
	1-4 hrs	Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	2.63	0.13	0.06	0.00	0.07	<0.01	0.19	0.01
Information for contributing scenario 11:										
PROC 19	>4 hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
Information for contributing scenario 12:										

PROC 7	>4hrs	Outdoors	306.25	15.31	6.43	0.32	8.51	0.43	21.88	1.09
		Indoors without LEV	437.5	21.88	9.19	0.46	12.15	0.61	31.25	1.56
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	183.75	9.19	3.86	0.19	5.10	0.26	13.13	0.66
		Indoors without LEV	262.5	13.13	5.51	0.28	7.29	0.36	18.75	0.94
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05

4 Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environmental releases:

In order to work within the boundaries of the ES the following conditions should be met:

- Local emission to air less than 70,000 kg/day
- When the on-site WWTP is used the WWTP sludge should not be spread to soil
- Emissions from the waste-water stream should be completely removed
- Residues may be sent to external waste treatment, on-site effluent treatment or recycled back into the manufacturing process.
- Measured emissions should be ensured to lead to concentrations in the environment which are less than the relevant PNEC
- Emissions to wastewater from laboratory use should not be to the municipal STP

Worker exposure:

In order to work within the boundaries of the ES the following conditions should be met:

- LEV should be in place in indoor facilities at times when natural ventilation is not sufficient.
- Where the potential for dermal exposure exists, gloves with a minimum efficiency of 90% and RPE with 95% efficiency should be worn.
- Health monitoring should be conducted regularly to ascertain the potential levels of exposure.
- Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) should be worn when any potential contact may arise.
- All technological devices should have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.
- Workers should be fully trained.
- Any measured worker exposure levels should be confirmed to be below the relevant DNEL as presented in section 3 above.

Annex to extended Safety Data Sheet (eSDS):

Downstream User Exposure Scenario for Ammonia

Exposure Scenario: Wide-dispersive Professional Use of Anhydrous and Aqueous Ammonia

1	Exposure Scenario

Wide dispersive professional uses of anhydrous and aqueous Ammonia as processing aids, non –processing aids and auxiliary agents.

Processes Covered:

Environmental Releases

ERC 8a: Wide dispersive indoor use of processing aids in open systems
ERC8b: Wide dispersive indoor use of reactive substances in open systems
ERC8d: Wide dispersive outdoor use of processing aids in open systems
ERC 8e: Wide dispersive outdoor use of reactive substances in open systems
ERC 9a: Wide dispersive indoor use of substances in closed systems
ERC 9b: Wide dispersive outdoor use of substances in closed systems
ERC11a: Wide dispersive indoor use of long-life articles and materials with low release

Worker Processes

PROC01: Use in closed process, no likelihood of exposure.
PROC02: Use in closed, continuous process with occasional controlled exposure.
PROC03: Use in closed batch processes
PROC04: Use in batch and other processes where the potential for exposure occurs
PROC05: Mixing and blending
PROC08a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.
PROC08b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.
PROC09: Transfer of formulations to small containers.
PROC10: Roller application or brushing of coatings
PROC11: Non-professional spraying
PROC13: Treatment of articles by dipping and pouring
PROC15: Laboratory use
PROC19: Low energy hand mixing
PROC20: Heat and pressure transfer fluids

Anhydrous liquid ammonia (>99.5 % wt) and aqueous ammonia solution (5-25% wt) are used by professional workers in a broad number of applications. Common applications include: use as a laboratory chemical, a refrigerant in cooling systems, a water treatment chemical, a fertiliser, a coating, paint thinner or paint remover, a photochemical, a cleaning product, a leather or other surface treatment product, a pH regulator or neutralisation agent and a process aid for nutrition.
Typical activities associated with the professional uses of ammonia where exposures can arise include operating equipment containing ammonia (e.g. opening and closing valves), transferring ammonia from storage containers using pipe or hoses, maintaining equipment and applying ammonia-based products (e.g. fertiliser, cleaning or surface treatment products).

Operational conditions pertaining to the broad range of professional end-use scenarios involving anhydrous and aqueous forms of ammonia vary considerably across applications. A full characterisation of the frequency and duration of tasks is therefore beyond the scope of this exposure scenario. For the purposes of worker exposure estimation, operational conditions have been represented generically based on the assumption that tasks may be either 1-4 hours or >4 hours in duration and that processes may be carried out either outdoors, indoors without LEV or indoors with LEV. These assumptions cover the broad range of tasks associated with professional uses of ammonia.

Contributing Environmental Scenario: Environmental exposure arising due to Wide dispersive professional uses of anhydrous and aqueous ammonia.

Contributing Worker Scenarios: Worker exposure arising due to day to day use in closed processes with no likelihood of exposure, day to day use in closed continuous processes with occasional exposure (such as sampling), day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance), mixing and blending, transfer to small containers, transfer of substance to and from large vessels and containers, roller and brushing application of coatings, treatment of articles by dipping and pouring, laboratory use, use in heat and pressure transfer fluids, hand mixing and non-professional spraying.

2.1	Contributing scenario 1 controlling environmental exposure for ES

Environmental exposure arising due to wide dispersive professional uses of anhydrous and aqueous ammonia.

Section 2.1 describes the environmental releases that may occur during the wide dispersive professional uses of anhydrous and aqueous ammonia. These releases may occur due to emission to wastewater or through emission to the atmosphere. Due to the wide dispersive nature these uses local source emissions are expected to be very small and significant concentrations in the environment are not expected.

Low level emission may be outdoor or indoor with emission directed to air or to the STP. In reality removal of ammonia in sewage treatment plants is highly efficient as ammonia solutions are readily biodegradable.

The majority of ammonia in the environment originates from natural sources, predominantly decaying organic matter.
Wide dispersive professional uses of ammonia are diverse and widespread. The resulting environmental exposure is not expected to add significantly to already present background levels of ammonia in the environment. An additional assessment for environmental exposure for wide dispersive uses has therefore not been presented in section 3 below.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Professional use is expected to see very small amounts used on a local scale with use widespread throughout the EU.

Frequency and duration of use

Variable low level use.

Environmental factors influenced by risk management

Large regional dilution and wide dispersive use pattern.

Other operational conditions affecting environmental exposure

Professional workers should be informed in order to prevent accidental release. Closed systems are employed in articles 9such as fridges) in order to prevent un-intended emissions.

Technical conditions and measures at process level (source) to prevent release

Closed articles for long-life use.

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

None-specifically required beyond standard good practice for professional workers.

Organizational measures to prevent/limit releases from site
Workers are trained in order to prevent accidental releases.
Conditions and measures related to municipal STP
Small low level local emissions may be released to the STP where removal is expected to be efficient due to the readily biodegradable nature of low concentration ammonia solutions.
Conditions and measures related to external treatment of waste for disposal
Any residual waste (such as empty bottles or old fridges and cooling systems) should be sent to landfill or for specialized disposal.
Conditions and measures related to external recovery of waste
There is no envisaged external recovery of ammonia waste.

2.2	**Contributing scenario 2 controlling worker exposure day to day use in closed processes with no likelihood of exposure.**

Worker exposure arising due to day to day use in closed processes with no likelihood of exposure during the professional end use processes.
Section 2.2 describes the potential exposure to workers during the professional end use of ammonia as an intermediate from operation of closed systems. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using

specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.3	**Contributing scenario 3 controlling worker exposure due to day to day use in closed continuous processes with occasional exposure (such as sampling)**

Worker exposure arising due to day to day use in closed continuous processes with occasional exposure (such as sampling).

Section 2.3 describes the potential exposure to workers during the professional end use of preparations of ammonia from the operation of closed systems with the potential for occasional exposure during tasks such as sampling, cleaning and maintenance. The potential exposure arises from the operation of professional end use equipment and its associated machinery and during routine sampling, cleaning and occasional maintenance.

Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in these tasks. Formulated solutions are stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia).

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.

Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.4	**Contributing scenario 4 controlling worker exposure for day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance)**

Worker exposure arising due to day to day use in batch or other processes with some potential for exposure (such as sampling, cleaning, maintenance).
Section 2.4 describes the potential exposure to workers during day to day use of professional machinery, pipelines and storage vessels. Potential exposure may occur during the day to day use however it is more likely to occur during tasks associated with the batch or other processes themselves such as cleaning and routine maintenance. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Solutions of ammonia are stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia). This contributing considers the potential exposures from batch and other processes (such as one off exposures) and though there is some potential for exposure generally systems are in place to control and losses or unintended emissions of ammonia at the professional facility.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use during batch and other processes is generally a short duration task, with limited potential for exposure occurring in reality.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.5	**Contributing scenario 5 controlling worker exposure for mixing and blending**

Worker exposure arising due to mixing and blending in batch processes during professional end use

Section 2.5 describes the potential exposure to workers during mixing and blending of ammonia formulations. Potential exposure may occur during the day to day use of machinery and technologies associated with the blending and mixing process as part of the overall professional end use of ammonia.

Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task. Stock ammonia is stored and transported as a liquid under pressure by rail, road or water in specialised, authorised containers (e.g. tanks and tank trucks approved for transporting ammonia).

Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.6	**Contributing scenario 6 controlling worker exposure for transfer to small containers**

Worker exposure arising due to transfer to small containers in a dedicated filling line.
Section 2.6 describes the potential exposure to workers during the filling of small containers in dedicated filling lines. Potential exposure is most likely to occur during tasks associated with the actual filling of the containers themselves. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures

and use of appropriate protective equipment.

2.7	**Contributing scenario 7 controlling worker exposure for transfer to and from large containers and vessels**

Worker exposure arising due transfer of ammonia to and from large containers and vessels

Section 2.7 describes the potential exposure to workers during the filling and loading to/from large vessels and containers in dedicated and non-dedicated filling lines. Potential exposure is most likely to occur during tasks associated with the actual filling of the containers and vessels themselves.

Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional end use is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with professional end use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Professional end-uses of anhydrous and aqueous forms of ammonia are diverse and should generally be carried out using specialized contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential fpr professionals to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room whenever possible.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps, tanks or during mixing etc). Extract ventilation is provided at openings and points were emission may

occur. Anhydrous ammonia is stored in closed containers and tanks. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for professional worker exposure. Workers involved in the wide dispersive professional uses of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.8	**Contributing scenario 8 controlling worker exposure for roller and brushing applications of coatings**

Worker exposure arising due to roller and brushing applications of coatings

Section 2.8 describes the potential exposure to workers during the professional end use of ammonia during roller and brushing applications to surfaces of coatings of ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional brushing and roller applications is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible. Workers should not be directly exposed to the application solutions.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with professional intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Professional end-uses of surface applied ammonia during roller and brushing applications involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers

being segregated in separate control rooms with no direct contact with chemical processing units The potential for professional workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, brushing equipment, pumps or tanks etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the professional end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.9	**Contributing scenario 9 controlling worker exposure for treatment of articles by dipping and pouring**

Worker exposure arising due to treatment of articles by dipping and pouring.

Section 2.9 describes the potential exposure to workers during the professional end use of ammonia during dipping and pouring treatment of articles using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional treatment of articles by dipping and pouring is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible. Workers should not be directly exposed to the article treatment solutions.

Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with professional intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Professional end-uses of surface applied ammonia during roller and brushing applications involve special equipment and high integrity contained systems with little or no potential for worker exposure. Facilities may be housed outdoors, with workers being segregated in separate control rooms with no direct contact with chemical processing units The potential for professional workers to be exposed to ammonia during these processes is therefore negligible since they are located in a separate control room.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, pumps or tanks etc). Extract ventilation is provided at openings and points were emission may occur. Anhydrous ammonia is stored in closed containers and tanks. Ammonia is transferred under containment. A good standard of general or controlled ventilation is applied when maintenance activities are carried out. Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the professional end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.10	**Contributing scenario 10 controlling worker exposure for laboratory use**

Worker exposure arising due to laboratory use of ammonia (small scale non-professional laboratories).

Section 2.10 describes the potential exposure to workers during laboratory use of ammonia especially during the filling and loading of small flasks and vessels using non-dedicated filling lines or small scale transfer methods. Potential exposure is most likely to occur during tasks associated with the actual transfer or mixing of the ammonia solutions.

For dedicated small scale laboratories appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable.

During laboratory use of ammonia solutions of aqueous ammonia in the 5 – 25% concentrations range are most liklety to be encountered. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable. It is this aqueous ammonia that is most likely to cause potential exposure for this contributing scenario.

Amounts used

Amounts use in a professional setting are likely to be small with less than 1 litre or 1 kilogram present on site. According to the guidance for this tonnage band, the default REACH number of emission days per year are 365 for wide dispersive uses however actual emission of ammonia is likely to be much less frequent in practice.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Again use of ammonia is not likely to be this frequent in practice.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

During the laboratory end use of ammonia indoors local exhaust ventilation may be in place. Personal protective equipment is also used to minimize the potential for dermal exposure during the transfer process. RPE is provided when required.
Technical conditions and measures at process level (source) to prevent release
During laboratory use LEV may or may not be in place (refer to section 3 below for relevant exposure levels for these cases). All technological devices should have a proper quality certification, and should be regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.
Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not considered sufficient or in enclosed areas.
Organizational measures to prevent/limit release
Laboratory workers are fully trained in safe use of chemicals in general and in the use of appropriate PPE in order to prevent accidental release or exposure.
Conditions and measures related to personal protection, hygiene and health.
Workers may potentially be exposed to ammonia during laboratory use when filling containers and vessels or during transfer. Extract ventilation is provided at openings and points were emissions may occur. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers are well-trained in the required procedures and the use of appropriate protective equipment. Where good natural ventilation is found to be inadequate, mechanical (general) ventilation or local exhaust ventilation (LEV) is provided. Personal protective clothing (e.g. face/eye/ear protection, helmet, gloves boots and protective overall) is worn when any potential contact may arise. Level A clothing (full encapsulating suit with self contained breathing apparatus) is used when handling large liquid spills or vapour clouds. Impervious clothing and rubber gloves are used for small liquid spills and normal loading and unloading operations. Safety shower/eye wash facilities are provided at sites which handle or store ammonia. Filtering respiratory masks are worn in case on the accidental release of ammonia.

2.11	**Contributing scenario 11 controlling worker exposure for hand mixing with intimate contact and PPE only**

Worker exposure arising due to hand mixing with intimate contact and PPE only.
Section 2.11 describes the potential exposure to workers during the professional end use of ammonia during hand mixing of formulations (with intimate contact and PPE only) using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia hand mixing in this case considered intimate contact and suitable PPE only.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release
Workers should not be directly exposed to the mixing solutions without PPE in place. LEV is generally not required.
Technical conditions to control dispersion from source towards worker
No specific measures aside from good professional practice is required.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of mixing equipment and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional hand mixing of ammonia would generally be carried out indoors using low energy methods and in vessels which should reduce the potential for un-intended loss. The potential for professional workers to be exposed to ammonia during these processes is therefore negligible since PPE and low emission methods are used. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the hand mixing of ammonia or ammonia solutions are well-trained in the required procedures and use of appropriate protective equipment.

2.12	**Contributing scenario 12 controlling worker exposure for professional spraying**

Worker exposure arising due to professional spraying and air dispersive techniques
Section 2.12 describes the potential exposure to workers during the professional end use of ammonia for spray applications using ammonia or ammonia containing solutions. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.
Product characteristics
Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.
Amounts used
Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.
Frequency and duration of use exposure
Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during professional spraying is generally a short duration task, with limited potential for exposure.
Human factors not influence by risk management
Respiration volume under conditions of use: 10 m^3/d Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).
Other given operational conditions affecting worker exposure
Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Technical conditions and measures at process level (source) to prevent release
Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible. Workers should not be directly exposed to the article treatment solutions.
Technical conditions to control dispersion from source towards worker

LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.

Organizational measures to prevent/limit release

Workers are fully trained in safe use of the machinery associated with professional intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Conditions and measures related to personal protection, hygiene and health.

Professional end-uses of sprayed ammonia during air dispersive applications involve special equipment and high integrity specialized systems.

Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps or tanks etc). Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise.

All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.

Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the professional end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

2.13	**Contributing scenario 13 controlling worker exposure for** use in heat and pressure transfer fluids

Worker exposure arising due to use in heat and pressure transfer fluids

Section 2.2 describes the potential exposure to workers during the professional end use of ammonia use in heat and pressure transfer fluid applications of ammonia based solutions in dispersive but closed systems. Appropriate PPE and onsite control parameters are in place to limit the risk of exposure to workers involved in this task.

Product characteristics

Anhydrous ammonia is a colourless gas at room temperature and pressure with a typical purity of around 99.9%. The vapour pressure of ammonia, anhydrous is reported to be 8611 hPa at 20 °C. Anhydrous ammonia is very soluble in water: reported water solubility values are 48200-53100 mg/L. Anhydrous ammonia is considered to be flammable. Formulated aqueous ammonia has a vapour pressure of 287 hPa and is considered readily biodegradable.

Amounts used

Small amounts are expected to be used on professional sites each year. As wide dispersive uses significant on-site tonnages are not expected for professional use.

Frequency and duration of use exposure

Workers perform standard shifts of 8 hours per day and have standard working years of 220 days per year. Potential exposure to ammonia during use in heat and pressure transfer fluids is generally a short duration task, with limited potential for exposure.

Human factors not influence by risk management

Respiration volume under conditions of use: 10 m^3/d
Area of skin contact with the substance under conditions of use: 480cm^2 (ECETOC default).

Other given operational conditions affecting worker exposure

Workers are fully trained in safe use and the use of appropriate PPE in order to prevent accidental release. Frequent monitoring for health effects may be conducted by medical surveillance programs.

Technical conditions and measures at process level (source) to prevent release

Systems and transfer pipelines should be closed and sealed. During indoor processes or in cases where natural ventilation is not sufficient LEV should be in place. For outdoor processes LEV is not generally required however system closure should still be in place when possible. Workers should not be directly exposed to the article treatment solutions.

Technical conditions to control dispersion from source towards worker
LEV should be in place during indoor operations when natural ventilation is not sufficient. Reactors and pipelines should be closed and sealed systems when possible.
Organizational measures to prevent/limit release
Workers are fully trained in safe use of the machinery associated with professional intermediate use and in the use of appropriate PPE in order to prevent accidental release or unintended exposure. Frequent monitoring for health effects may be conducted by medical surveillance programs.
Conditions and measures related to personal protection, hygiene and health.
Professional end-uses of ammonia lubricants for use in heat and pressure transfer fluid applications involve special equipment and high integrity specialized systems. Workers may potentially be exposed to ammonia when conducting field activities (e.g. when operating valves, spraying machinery, pumps or tanks etc). Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) is worn when any potential contact may arise. All technological devices have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia. Good occupational hygiene and exposure control measures are implemented to minimise the potential for worker exposure. Workers involved in the professional end use of ammonia are well-trained in the required procedures and use of appropriate protective equipment.

3	**Exposure estimation and reference to its source**

The assessment of worker exposure to anhydrous and aqueous ammonia during professional uses (ES 5) was carried out for process categories relevant to this scenario as identified by PROC codes: use and storage of ammonia in closed systems with no likelihood of exposure (PROC 1), use in closed, continuous processes with occasional controlled exposure (PROC 2), formulation using closed batch processes (PROC 3), use in batch or other processes (PROC 4), mixing or blending in a batch process (PROC 5), maintenance and clean-down (PROC 8a), transfer (PROC 8b), transfer of ammonia into containers (PROC 9), brush and roller applications (PROC 10), spraying (PROC 11), treatment of articles by dipping and pouring (PROC 13), and analysis of samples (PROC 15), hand-mixing (PROC 19) and heat and pressure transfer in closed systems (PROC 20).
A screening-level (Tier 1) assessment of worker exposure was carried out using the ECETOC Targeted Risk Assessment (TRA) model. The ECETOC TRA was used to predict dermal exposures (expressed as a daily systemic dose in mg/kg bw) and inhalation exposure concentrations (expressed as an airborne concentration in mg/m^3) associated with each process defined by PROC codes.

Exposure to workers was assessed taking into account different operational conditions that may be associated with the professional use of ammonia and the impact of different exposure control measures. Exposures were determined for task durations of 1- 4 hours or >4 hours and assuming that process are carried out either outdoors, indoors without use of local exhaust ventilation (LEV) or indoors with the use of LEV. To reflect the use of personal protective equipment (PPE), dermal exposures were determined assuming either no gloves or gloves affording 90% protection of the hands are worn. To reflect the use of respiratory protective equipment (RPE), inhalation exposures concentrations were determined assuming either no RPE or RPE affording 95% protection is worn.

The ECETOC TRA model uses a simple algorithm to determine dermal exposures that does not take the physical-chemical properties of a substance into account. The same dermal exposures where therefore predicted for anhydrous and aqueous forms of ammonia. Parameters used in the ECETOC TRA model to assess inhalation exposures were: molecular weight (35 $g.mol^{-1}$ and 17 $g.mol^{-1}$ for aqueous and anhydrous forms respectively and vapour pressure (the vapour pressure of anhydrous forms of ammonia is 8.6×10^5 Pa at 20^oC, whereas the vapour pressure of aqueous ammonia solution between 5 and 25% w/w ranges from 5×10^3 Pa to 4×10^4 Pa at 20^oC. Systemic dermal exposures have been determined for a worker with bodyweight 70 kg.

The following values were obtained using ECETOC TRA for worker exposure

Dermal exposures predicted using the ECETOC TRA model

Description of activity	PROC	Exposure assumptions		Estimated Exposure mg/kg bw/d	
		Duration	Use of ventilation	No gloves worn	Gloves worn (90% reduction)
Information for contributing scenario 2:					
Use in a closed process, no likelihood of exposure: storage (closed or bulk container)	PROC 1	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03
Information for contributing scenario 3:					
Use in a closed, continuous process with occasional controlled exposure (e.g. sampling)	PROC 2	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	1.37	0.14
			Indoors with LEV	0.14	0.01
Information for contributing scenario 4:					
Use in closed batch process (synthesis or formulation)	PROC 3	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03
		1-4 hrs or >4 hrs	Indoors with LEV	0.03	<0.01
Use in batch process (synthesis) where opportunity for exposure arises	PROC 4	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 5:					
Mixing or blending in batch process	PROC 5	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
		1-4 hrs or >4 hrs	Indoors with LEV	0.07	0.01
Information for contributing scenario 6:					
Transfer into small containers	PROC 9	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 7:					
Transfer (charging/discharging) from or to vessels or large containers at non-dedicated facilities	PROC 8a	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
			Indoors with LEV	0.14	0.01
Transfer (charging/discharging) from or to vessels or large containers at dedicated facilities	PROC 8b	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69
			Indoors with LEV	0.69	0.07
Information for contributing scenario 8:					

Roller application or brushing	PROC 10	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	27.43	0.14
		1-4 hrs or >4 hrs	Indoors with LEV	1.37	10.71
Information for contributing scenario 9:					
Treatment of articles by dipping and pouring	PROC 13	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37
		1-4 hrs or >4 hrs	Indoors with LEV	0.69	0.07
Information for contributing scenario 10:					
Laboratory use : Quality control in a laboratory	PROC 15	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03
		1-4 hrs or >4 hrs	Indoors with LEV	0.03	<0.01
Information for contributing scenario 11:					
Hand-mixing with intimate contact and PPE only	PROC 19	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	141.73	14.13
Information for contributing scenario 12:					
Non industrial spraying	PROC 11	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	107	10.71
		1-4 hrs or >4 hrs	Indoors with LEV	2.14	0.21
Information for contributing scenario 13:					
Heat and pressure transfer fluids in dispersive use but closed systems	PROC 20	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	1.71	0.17
		1-4 hrs or >4 hrs	Indoors with LEV	0.14	0.01

Inhalation exposure concentrations predicted using the ECETOC TRA model

				Anhydrous ammonia		**Aqueous ammonia (5-25% w/w)**	
Description of activity	**PROC**	**Exposure assumptions**		**Estimated Exposure Concentration mg/m3**			
		Duration	**Use of ventilation**	**No RPE**	**RPE (95% reduction)**	**No RPE**	**RPE (95% reduction)**
Information for contributing scenario 2:							
Used in a closed process, no likelihood of exposure: Storage (closed bulk or container)	PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	0.01	NA
		1-4 hrs or >4 hrs	Indoors without LEV	0.01	NA	0.01	NA
Information for contributing scenario 3:							
Use in a closed, continuous process	PROC 2	>4hrs	Outdoors	24.79	1.24	30.63	1.53

continuous process with occasional controlled exposure (e.g. sampling)		>4hrs	Indoors without LEV	35.42	1.77	43.75	2.19
		>4hrs	Indoors with LEV	3.53	0.18	4.38	0.22
		1-4 hrs	Outdoors	14.88	0.74	18.38	0.92
		1-4 hrs	Indoors without LEV	22.25	1.06	26.25	1.31
		1-4 hrs	Indoors with LEV	2.13	0.11	2.63	0.13
Information for contributing scenario 4:							
Use in closed batch process (synthesis or formulation)	PROC 3	>4hrs	Outdoors	49.58	2.48	61.25	3.06
		>4hrs	Indoors without LEV	70.83	3.54	87.5	4.38
		>4hrs	Indoors with LEV	7.08	0.35	8.75	0.44
		1-4 hrs	Outdoors	29.75	1.49	36.75	1.84
		1-4 hrs	Indoors without LEV	42.5	2.13	52.50	2.63
		1-4 hrs	Indoors with LEV	4.25	0.21	5.25	0.26
Use in batch process (synthesis) where opportunity for exposure arises	PROC 4	>4hrs	Outdoors	49.58	2.48	61.25	3.06
		>4hrs	Indoors without LEV	70.83	3.54	87.5	4.38
		>4hrs	Indoors with LEV	7.08	0.35	8.75	0.44
		1-4 hrs	Outdoors	29.75	1.49	36.75	1.84
		1-4 hrs	Indoors without LEV	42.5	2.13	52.5	2.63
		1-4 hrs	Indoors with LEV	4.25	0.21	5.25	0.26
Information for contributing scenario 5:							
Mixing or blending in batch process	PROC 5	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Information for contributing scenario 6:							
Maintenance, clean down	PROC 8a	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Transfer of ammonia (charging/discharging) from/to vessels or large containers at dedicated facilities	PROC 8b	>4hrs	Outdoors	74.38	3.72	91.88	4.59
		>4hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		>4hrs	Indoors with LEV	3.19	0.16	3.94	0.20
		1-4 hrs	Outdoors	44.63	2.23	55.13	2.76
		1-4 hrs	Indoors without LEV	63.75	3.19	78.75	3.94

		1-4 hrs	Indoors with LEV	1.91	0.1	2.36	0.12
Information for contributing scenario 7:							
Transfer into small containers	PROC 9	>4hrs	Outdoors	99.17	4.96	122.50	6.13
		>4hrs	Indoors without LEV	141.67	7.08	175.00	8.75
		>4hrs	Indoors with LEV	14.17	0.71	17.50	0.88
		1-4 hrs	Outdoors	59.50	2.98	73.50	3.68
		1-4 hrs	Indoors without LEV	85.00	4.25	105.00	5.25
		1-4 hrs	Indoors with LEV	8.5	0.43	10.50	0.53
Information for contributing scenario 8:							
Roller application or brushing	PROC 10	>4hrs	Outdoors	NA	NA	153.13	7.66
		>4hrs	Indoors without LEV	NA	NA	218.75	10.94
		>4hrs	Indoors with LEV	NA	NA	21.88	1.09
		1-4 hrs	Outdoors	NA	NA	91.88	4.59
		1-4 hrs	Indoors without LEV	NA	NA	131.25	6.56
		>4hrs	Outdoors	NA	NA	13.13	0.66
Information for contributing scenario 9:							
Treatment of articles by dipping and pouring	PROC 13	>4hrs	Outdoors	123.96	6.20	153.13	7.66
		>4hrs	Indoors without LEV	177.08	8.85	218.75	10.94
		>4hrs	Indoors with LEV	17.71	0.89	21.88	1.09
		1-4 hrs	Outdoors	74.38	3.72	91.88	4.59
		1-4 hrs	Indoors without LEV	106.25	5.31	131.25	6.56
		1-4 hrs	Indoors with LEV	10.63	0.53	13.13	0.66
Information for contributing scenario 10:							
Quality control in a laboratory	PROC 15	>4hrs	Indoors without LEV	35.42	1.77	43.75	2.19
		>4hrs	Indoors with LEV	3.54	0.18	4.38	0.22
		1-4 hrs	Indoors without LEV	21.25	1.06	26.25	1.31
		1-4 hrs	Indoors with LEV	2.13	0.11	2.63	0.13
Information for contributing scenario 11:							
Hand-mixing with intimate contact and PPE only	PROC 19	<4 hrs	Outdoors	NA	NA	153.13	7.66
		<4 hrs	Indoors without LEV	NA	NA	218.75	10.94
		1-4 hrs	Outdoors	NA	NA	91.88	4.59
		1-4 hrs	Indoors without LEV	NA	NA	131.25	6.56
Information for contributing scenario 12:							
Non-industrial (professional) spraying	PROC 11	>4hrs	Outdoors	NA	NA	613.20	30.66
		>4hrs	Indoors without LEV	NA	NA	876.00	43.80
		>4hrs	Indoors with LEV	NA	NA	175.20	8.76
		1-4 hrs	Outdoors	NA	NA	367.92	18.40
		1-4 hrs	Indoors without LEV	NA	NA	525.60	26.28
		>4hrs	Outdoors	NA	NA	105.12	5.26

Information for contributing scenario 13:							
Heat and pressure transfer fluids in dispersive use but closed systems	PROC 20	>4hrs	Outdoors	24.79	1.24	30.63	1.53
		>4hrs	Indoors without LEV	35.42	1.77	43.75	2.19
		>4hrs	Indoors with LEV	7.08	0.35	8.75	0.44
		1-4 hrs	Outdoors	14.88	0.74	18.38	0.92
		1-4 hrs	Indoors without LEV	21.25	1.06	26.25	1.31
		1-4 hrs	Indoors with LEV	4.25	0.21	5.25	0.26

The following RCR values were obtained using ECETOC TRA and the relevant DNELs

Quantitative risk characterisation of dermal exposures to anhydrous or aqueous (in preparations of 5- 25 % w/w) ammonia for professional workers (ES 5 – Professional end-use)

PROC code	**Exposure assumptions**		**ES 4- exposure concentrations (EC) mg/kg bw/d**		**Acute / long term systemic effects** **DNEL = 6.8 mg/kg bw/d**	
					Risk characterisation ratio	
	Duration	**Use of ventilation**	**No gloves worn**	**Gloves worn (90% reduction)**	**No gloves worn**	**Gloves worn (90% reduction)**
Information for contributing scenario 2:						
PROC 1	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03	0.05	0.01
Information for contributing scenario 3:						
PROC 2	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	1.37	0.14	0.20	0.02
		Indoors with LEV	0.14	0.01	0.02	<0.01
Information for contributing scenario 4:						
PROC 3	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	0.34	0.03	0.05	0.01
		Indoors with LEV	0.03	<0.01	0.01	<0.01
PROC 4	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 5:						
PROC 5	1-4 hrs or >4 hrs	Outdoors /Indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.07	0.01	0.01	<0.01
Information for contributing scenario 6:						
PROC 8a	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37	2.02	0.20

	or >4 hrs	Indoors with LEV	0.14	0.01	0.02	<0.01
PROC 8b	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 7:						
PROC 9	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	6.86	0.69	1.01	0.10
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 9:						
PROC 13	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	13.71	1.37	2.02	0.20
		Indoors with LEV	0.69	0.07	0.10	0.01
Information for contributing scenario 10:						
PROC 15	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	0.34	0.03	0.05	0.01
		Indoors with LEV	0.03	<0.01	0.01	<0.01
Information for contributing scenario 13:						
PROC 20	1-4 hrs or >4 hrs	Outdoors / Indoors without LEV	1.71	0.17	0.25	0.03
		Indoors with LEV	0.14	0.01	0.02	<0.01

Quantitative risk characterisation of inhalation exposure concentrations of anhydrous ammonia for professional workers (ES 5 – Professional end-use)

PROC code	**Exposure assumptions**		**ES 4-exposure concentrations (EC) mg/m^3**		**Acute / long-term systemic effects** **DNEL = 47.6 mg/m3**		**Acute-local effects** **DNEL = 36 mg/m3**		**Long-term local effects** **DNEL = 14 mg/m3**	
					RCR		**RCR**		**RCR**	
	Duration	**Use of ventilation**	**No RPE**	**RPE -95% reduction**	**No RPE**	**RPE – 95% reduction**	**No RPE**	**RPE 95% reduction**	**No RPE**	**RPE -95% reduction**
Information for contributing scenario 2:										
PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	<0.01	NA	<0.01	NA	<0.01	NA
		Indoors without LEV	0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA
Information for contributing scenario 3:										
PROC 2	>4hrs	Outdoors	24.79	1.24	0.52	0.03	0.69	0.03	1.77	0.09
		Indoors without LEV	35.42	1.77	0.74	0.04	0.98	0.05	2.53	0.13
		Indoors with LEV	3.54	0.18	0.07	0.00	0.10	<0.01	0.25	0.01
	1-4 hrs	Outdoors	14.88	0.74	0.31	0.02	0.41	0.02	1.06	0.05
		Indoors without LEV	22.25	1.06	0.47	0.02	0.59	0.03	1.52	0.08

		Indoors with LEV	2.13	0.11	0.04	0.00	0.06	<0.01	0.15	0.01
Information for contributing scenario 4:										
PROC 3	>4hrs	Outdoors	49.58	2.48	1.04	0.05	1.38	0.07	3.54	0.18
		Indoors without LEV	70.83	3.54	1.49	0.07	1.97	0.10	5.06	0.25
		Indoors with LEV	7.08	0.35	0.15	0.01	0.20	0.01	0.51	0.03
	1-4 hrs	Outdoors	29.75	1.49	0.63	0.03	0.83	0.04	2.13	0.11
		Indoors without LEV	42.5	2.13	0.89	0.04	1.18	0.06	3.04	0.15
		Indoors with LEV	4.25	0.21	0.09	0.00	0.12	0.01	0.30	0.02
PROC 4	>4hrs	Outdoors	49.58	2.48	1.04	0.05	1.38	0.07	3.54	0.18
		Indoors without LEV	70.83	3.54	1.49	0.07	1.97	0.10	5.06	0.25
		Indoors with LEV	7.08	0.35	0.15	0.01	0.20	0.01	0.51	0.03
	1-4 hrs	Outdoors	29.75	1.49	0.63	0.03	0.83	0.04	2.13	0.11
		Indoors without LEV	42.5	2.13	0.89	0.04	1.18	0.06	3.04	0.15
		Indoors with LEV	4.25	0.21	0.09	0.00	0.12	0.01	0.30	0.02
Information for contributing scenario 5:										
PROC 5	>4hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44
		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
Information for contributing scenario 6:										
PROC 8a	>4hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44
		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
PROC 8b	>4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	3.19	0.16	0.07	0.00	0.09	<0.01	0.23	0.01
	1-4 hrs	Outdoors	44.63	2.23	0.94	0.05	1.24	0.06	3.19	0.16
		Indoors without LEV	63.75	3.19	1.34	0.07	1.77	0.09	4.55	0.23
		Indoors with LEV	1.91	0.10	0.04	0.00	0.05	<0.01	0.14	0.01
Information for contributing scenario 7:										

PROC 9	>4 hrs	Outdoors	99.17	4.96	2.08	0.10	2.75	0.14	7.08	0.35
		Indoors without LEV	141.67	7.08	2.98	0.15	3.94	0.20	10.12	0.51
		Indoors with LEV	14.17	0.71	0.30	0.01	0.39	0.02	1.01	0.05
	1-4 hrs	Outdoors	59.50	2.98	1.25	0.06	1.65	0.08	4.25	0.21
		Indoors without LEV	85.00	4.25	1.79	0.09	2.36	0.12	6.07	0.30
		Indoors with LEV	8.5	0.43	0.18	0.01	0.24	0.01	0.61	0.03
Information for contributing scenario 9:										
PROC 13	>4 hrs	Outdoors	123.96	6.20	2.60	0.13	3.44	0.17	8.85	0.44
		Indoors without LEV	177.08	8.85	3.72	0.19	4.92	0.25	12.65	0.63
		Indoors with LEV	17.71	0.89	0.37	0.02	0.49	0.02	1.26	0.06
	1-4 hrs	Outdoors	74.38	3.72	1.56	0.08	2.07	0.10	5.31	0.27
		Indoors without LEV	106.25	5.31	2.23	0.11	2.95	0.15	7.59	0.38
		Indoors with LEV	10.63	0.53	0.22	0.01	0.30	0.01	0.76	0.04
Information for contributing scenario 10:										
PROC 15	>4 hrs	Indoors without LEV	35.42	1.77	0.74	0.04	0.98	0.05	2.53	0.13
		Indoors with LEV	3.54	0.18	0.07	0.00	0.10	<0.01	0.25	0.01
	1-4 hrs	Indoors without LEV	21.25	1.06	0.45	0.02	0.59	0.03	1.52	0.08
		Indoors with LEV	2.13	0.11	0.04	0.00	0.06	<0.01	0.15	0.01
Information for contributing scenario 13:										
PROC 20	>4 hrs	Outdoors	24.79	1.24	0.52	0.03	0.69	0.03	1.77	0.09
		Indoors without LEV	35.42	1.77	0.74	0.04	0.98	0.05	2.53	0.13
		Indoors with LEV	7.08	0.35	0.15	0.01	0.20	0.01	0.51	0.03
	1-4 hrs	Outdoors	14.88	0.74	0.31	0.02	0.41	0.02	1.06	0.05
		Indoors without LEV	21.25	1.06	0.45	0.02	0.59	0.03	1.52	0.08
		Indoors with LEV	4.25	0.21	0.09	0.00	0.12	0.01	0.30	0.02

Quantitative risk characterisation of inhalation exposure concentrations of aqueous ammonia (in preparations of 5-25% w/w) in professional workers (ES 4 – Professional end-use)

PROC code	**Exposure assumptions**		**ES 4- exposure concentrations (EC) mg/m^3**		**Acute /long-term systemic effects** **DNEL = 47.6 mg/m3**		**Acute – local effects** **DNEL = 36 mg/m3**		**Long-term local effects** **DNEL = 14 mg/m3**	
					RCR		**RCR**		**RCR**	
	Duration	**Use of ventilation**	**No RPE**	**RPE (95% reduction)**	**No RPE**	**RPE - 95% reduction**	**No RPE**	**RPE -95% reduction**	**No RPE**	**RPE -95% reduction**

Information for contributing scenario 2:										
PROC 1	1-4 hrs or >4 hrs	Outdoors	0.00	NA	<0.01	NA	<0.01	NA	<0.01	NA
		Indoors without LEV	0.01	NA	<0.01	NA	<0.01	NA	<0.01	NA
Information for contributing scenario 3:										
PROC 2	>4hrs	Outdoors	30.63	1.53	0.64	0.03	0.85	0.04	2.19	0.11
		Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	4.38	0.22	0.09	0.00	0.12	0.01	0.31	0.02
	1-4 hrs	Outdoors	18.38	0.92	0.39	0.02	0.51	0.03	1.31	0.07
		Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	2.63	0.13	0.06	0.00	0.07	<0.01	0.19	0.01
Information for contributing scenario 4:										
PROC 3	>4hrs	Outdoors	61.25	3.06	1.29	0.06	1.70	0.09	4.38	0.22
		Indoors without LEV	87.5	4.38	1.84	0.09	2.43	0.12	6.25	0.31
		Indoors with LEV	8.75	0.44	0.18	0.01	0.24	0.01	0.63	0.03
	1-4 hrs	Outdoors	36.75	1.84	0.77	0.04	1.02	0.05	2.63	0.13
		Indoors without LEV	52.50	2.63	1.10	0.06	1.46	0.07	3.75	0.19
		Indoors with LEV	5.25	0.26	0.11	0.01	0.15	0.01	0.38	0.02
PROC 4	>4hrs	Outdoors	61.25	3.06	1.29	0.06	1.70	0.09	4.38	0.22
		Indoors without LEV	87.5	4.38	1.84	0.09	2.43	0.12	6.25	0.31
		Indoors with LEV	8.75	0.44	0.18	0.01	0.24	0.01	0.63	0.03
	1-4 hrs	Outdoors	36.75	1.84	0.77	0.04	1.02	0.05	2.63	0.13
		Indoors without LEV	52.5	2.63	1.10	0.06	1.46	0.07	3.75	0.19
		Indoors with LEV	5.25	0.26	0.11	0.01	0.15	0.01	0.38	0.02
Information for contributing scenario 5:										
PROC 5	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 6:										

PROC 8a	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
PROC 8b	>4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	3.94	0.20	0.08	0.00	0.11	0.01	0.28	0.01
	1-4 hrs	Outdoors	55.13	2.76	1.16	0.06	1.53	0.08	3.94	0.20
		Indoors without LEV	78.75	3.94	1.65	0.08	2.19	0.11	5.63	0.28
		Indoors with LEV	2.36	0.12	0.05	0.00	0.07	<0.01	0.17	0.01
Information for contributing scenario 7:										
PROC 9	>4hrs	Outdoors	122.50	6.13	2.57	0.13	3.40	0.17	8.75	0.44
		Indoors without LEV	175.00	8.75	3.68	0.18	4.86	0.24	12.50	0.63
		Indoors with LEV	17.50	0.88	0.37	0.02	0.49	0.02	1.25	0.06
	1-4 hrs	Outdoors	73.50	3.68	1.54	0.08	2.04	0.10	5.25	0.26
		Indoors without LEV	105.00	5.25	2.21	0.11	2.92	0.15	7.50	0.38
		Indoors with LEV	10.50	0.53	0.22	0.01	0.29	0.01	0.75	0.04
Information for contributing scenario 8:										
PROC 10	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 9:										
PROC 13	>4hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
		Indoors with LEV	21.88	1.09	0.46	0.02	0.61	0.03	1.56	0.08
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47

		without LEV								
		Indoors with LEV	13.13	0.66	0.28	0.01	0.36	0.02	0.94	0.05
Information for contributing scenario 10:										
PROC 15	>4 hrs	Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	4.38	0.22	0.09	0.00	0.12	0.01	0.31	0.02
	1-4 hrs	Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	2.63	0.13	0.06	0.00	0.07	<0.01	0.19	0.01
Information for contributing scenario 11:										
PROC 19	>4 hrs	Outdoors	153.13	7.66	3.22	0.16	4.25	0.21	10.94	0.55
		Indoors without LEV	218.75	10.94	4.60	0.23	6.08	0.30	15.63	0.78
	1-4 hrs	Outdoors	91.88	4.59	1.93	0.10	2.55	0.13	6.56	0.33
		Indoors without LEV	131.25	6.56	2.76	0.14	3.65	0.18	9.38	0.47
Information for contributing scenario 12:										
PROC 11	>4hrs	Outdoors	613.20	30.66	12.88	0.64	17.03	0.85	43.80	2.19
		Indoors without LEV	876.00	43.80	18.40	0.92	24.33	1.22	62.57	3.13
		Indoors with LEV	175.20	8.76	3.68	0.18	4.87	0.24	12.51	0.63
	1-4 hrs	Outdoors	367.92	18.40	7.73	0.39	10.22	0.51	26.28	1.31
		Indoors without LEV	525.60	26.28	11.04	0.55	14.60	0.73	37.54	1.88
		Indoors with LEV	105.12	5.26	2.21	0.11	2.92	0.15	7.51	0.38
Information for contributing scenario 13:										
PROC 20	>4hrs	Outdoors	30.63	1.53	0.64	0.03	0.85	0.04	2.19	0.11
		Indoors without LEV	43.75	2.19	0.92	0.05	1.22	0.06	3.13	0.16
		Indoors with LEV	8.75	0.44	0.18	0.01	0.24	0.01	0.63	0.03
	1-4 hrs	Outdoors	18.38	0.92	0.39	0.02	0.51	0.03	1.31	0.07
		Indoors without LEV	26.25	1.31	0.55	0.03	0.73	0.04	1.88	0.09
		Indoors with LEV	5.25	0.26	0.11	0.01	0.15	0.01	0.38	0.02

4	**Guidance to DU to evaluate whether he works inside the boundaries set by the ES**

Environmental releases:

- As no environmental exposure is presented no specific requirements aside from standard good professional practices are needed

Worker exposure:

In order to work within the boundaries of the ES the following conditions should be met:

- LEV should be in place in indoor facilities at times when natural ventilation is not sufficient.
- Where the potential for dermal exposure exists, gloves with a minimum efficiency of 90% and RPE with 95% efficiency should be worn.
- Health monitoring should be conducted regularly to ascertain the potential levels of exposure.
- Personal protective clothing (e.g. face/eye protection, helmet, gloves, boots and protective overalls) should be worn when any potential contact may arise.
- All technological devices should have a proper quality certification, and are regularly controlled and maintained to avoid the uncontrolled discharge of ammonia.
- Workers should be fully trained.
- Any measured worker exposure levels should be confirmed to be below the relevant DNEL as presented in section 3 above.