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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Résumé

Une centaine de personnes, venues de 16 pays ainsi que de la Commission des Communautés Européennes, ont participé au séminaire OCDE sur << Les stratégies pour le transport routier de marchandises dangereuses : sécurité et protection de l'environnement>>. L'université, l'industrie et les organisations syndicales étaient représentées en plus des gouvernements nationaux et locaux. Malheureusement, la CEE n'a pas été représentée. Plus de trente-cinq présentations ont été délivrées. La réunion a été organisée par les Autorités suédoises, en coopération avec le Programme de recherche en matière de routes et de transports routiers de l'OCDE ainsi que la Direction de l'Environnement de l'OCDE.

Au cours de la réunion, de nombreuses questions concernant la prévention, l'état d'alerte et la réponse en matière d'accidents impliquant des marchandises dangereuses ont été abordées. Une des prémisses fondamentales de la réunion était que l'objectif de toutes les parties prenantes devrait être d'éviter de tels accidents mais qu'<<il est probable que quelque chose d'improbable survienne>> (Aristote). Dans ce contexte, la réunion a débouché sur les conclusions suivantes :

Information et statistiques

1. Il est nécessaire d'améliorer le recueil de l'information et des statistiques relatives à la portée et la nature du transport des marchandises dangereuses ainsi qu'aux accidents de transport impliquant de telles marchandises. Ces informations et statistiques devraient être mises à la disposition de ceux qui décident des politiques relatives aux accidents de transport et ils devraient les mettre en commun afin d'en tirer des leçons en matière de prévention des accidents et planification d'urgence. Des efforts doivent être faits en vue de faciliter la mise en commun de l'information et l'expérience aux plans national et international, par exemple en mettant au point un dispositif international de recueil de l'information et des statistiques pertinentes et/ou en harmonisant la nature de l'information recueillie et la forme sous laquelle elle est recueillie.

2. Il a été noté que le recueil d'une information complète sur tous les transports de marchandises dangereuses est une tâche complexe qui peut exiger des ressources et des dépenses considérables, qui dans de nombreux pays ne sont pas disponibles. Toutefois, l'information nécessaire à la prise de décision sur la prévention des accidents et la réponse d'urgence peut être obtenue en utilisant des méthodes appropriées de sondage pour le recueil des données. Il est bien entendu qu'il faut être prudent dans l'interprétation de l'information relative au transport de marchandises dangereuses car les hypothèses faites lors du recueil de l'information tout comme les moyens utilisés peuvent en affecter l'interprétation.

3. Il a été reconnu que, dans la plupart des cas, ce sont les effets potentiels sur la santé des individus et les biens qui servent à définir les <<marchandises dangereuses>> à des fins de contrôle du transport de ces marchandises et de recueil de l'information sur le transport de marchandises dangereuses et les accidents au

cours de ces transports. Des travaux complémentaires sont nécessaires pour examiner la question des effets sur l'environnement, déterminer quels sont les types de marchandises dangereuses susceptibles d'avoir un effet significatif sur l'environnement en cas de fuite lors d'un accident de transport, passer en revue l'information existante et obtenir de meilleures informations relative à la nature et à la portée du transport de ces marchandises. Les difficultés associées au recueil de ces informations ont été reconnues. Par exemple, le recueil de l'information concernant les effets sur l'environnement reste compliqué en raison de la prise en compte du milieu dans lequel survient la fuite de produits dangereux, de la persistance du caractère dangereux des produits, etc.

Analyse du risque

4. L'analyse du risque constitue un important outil de prévention des accidents de transport et de l'état d'alerte. Les analyses du risque peuvent être utilisées comme l'une des entrées du processus de décision relatif, par exemple, pour les comparaisons entre les différents modes de transport et entre les différentes variantes d'itinéraire pour le trafic de marchandises dangereuses, ainsi que pour les décisions relatives à la conception des véhicules et citernes. A cet égard, il a été noté que dans quelques pays, l'évaluation quantitative du risque (EQR) s'est avérée utile dans la prise de décisions relatives à divers aspects liés à la prévention des accidents et à la planification d'urgence tels que la planification physique et la définition d'itinéraires pour les véhicules de transport. L'EQR permet un classement relatif des risques et fournit une aide pour déterminer les mesures préventives appropriées.

5. Actuellement, les analyses du risque portent essentiellement sur les risques pour la santé des personnes en général. Si, dans la plupart des cas, il s'agit d'une préoccupation majeure, d'autres aspects doivent également être pris en considération, en particulier les risques pour l'environnement. Pour permettre l'évaluation de ces risques et leur importance relative par rapport aux risques pour la santé humaine, il sera nécessaire de mettre au point des méthodes et critères d'évaluation largement acceptés lorsque cela s'avère nécessaire.

6. Il convient de noter qu'actuellement les données faisant le rapprochement entre accidents et transport de marchandises dangereuses sont rares. En conséquence, l'analyse des risques lorsqu'elle est appliquée à ces transports, doit se fonder sur un certain nombre d'hypothèses et ne devrait pas être utilisée pour calculer la probabilité d'accidents sans reconnaître ses limites. Toutefois lorsqu'on l'applique aux différents itinéraires pour une demande de transport donnée, l'analyse du risque peut permettre une évaluation raisonnablement précise des risques relatifs.

7. Il a été reconnu que les systèmes internationaux existants de regroupement des produits chimiques dangereux uniquement par classe de danger ne sont pas adaptés à l'évaluation de l'information sur les accidents ou pour mener des analyses du risque concernant les accidents de transport impliquant des marchandises dangereuses. Une information plus spécifique sur la substance chimique comme son numéro d'identification ONU, est nécessaire pour de telles évaluations et analyses.

8. Des travaux complémentaires sont nécessaires pour mieux comprendre les différences entre méthodes d'analyse du risque, les limitations de ces méthodes, le degré de confiance dans les résultats et la meilleure manière d'utiliser les analyses du risque. A cet égard, il a été signalé que des travaux complémentaires devraient être engagés par une organisation internationale adéquate en vue de développer une meilleure compréhension des méthodologies et applications de l'analyse de risque, y compris les exigences et critères en matière de données utilisées dans les pays Membres. Ce travail devrait être exhaustif de manière à refléter la gamme complète des facteurs économiques, environnementaux, de santé publique et autres, associés au transport de marchandises dangereuses par tous les modes (voies navigables, rail et route).

9. Tout travail relatif aux analyses du risque d'accidents de transport devrait veiller à éviter les doubles emplois avec les travaux menés dans les domaines connexes et, à cet égard, toute action nouvelle dans ce domaine devrait tirer avantage de l'expérience acquise grâce aux analyses de risque sur les installations fixes. Les leçons tirées de ces analyses du risque peuvent être utilement appliquées dans les analyses du transport de marchandises dangereuses pour lesquelles on dispose d'une expérience plus limitée. Les techniques élémentaires utilisées pour les installations fixes et pour le transport seront identiques mais l'application de ces techniques au transport n'est pas aussi bien développée si l'on considère par exemple la nécessité de définir la nature et la portée d'une exposition éventuelle pour une population dispersée, de la congestion du trafic, etc. Il a été noté que les concepts de risque individuel et collectif sont pertinents pour les installations fixes alors que pour le transport routier, en particulier, le risque individuel est en général faible. Il s'en suit que le concept de risque collectif est le plus intéressant, sauf dans des zones bien spécifiques.

10. On a décrit une méthodologie de prévision du coût futur des accidents de la route, fondée sur une étude approfondie des conséquences et coûts connus (y compris les coûts pour les collectivités locales, l'industrie, etc.) d'un nombre limité d'accidents représentatifs. Si elle constitue un outil intéressant pour la prise de décision, il a été reconnu que les différents coûts vont varier significativement d'un pays ou d'une région à l'autre en raison des conditions locales comme le cadre juridique, le système routier, etc. Des travaux complémentaires devraient être entrepris dans le domaine de la quantification des coûts associés aux accidents de transport.

Rôles et responsabilités des parties prenantes

11. D'importantes discussions ont porté sur les responsabilités et rôles, en général, des pouvoirs publics ainsi que des différents secteurs de l'industrie (tels que constructeurs, chargeurs, transporteurs, etc.), y compris l'encadrement et les travailleurs. Référence a été faite à *Accidents chimiques : Principes directeurs pour la prévention, la préparation et l'intervention* de l'OCDE. Ce document traite essentiellement des installations fixes, mais il indique également les rôles et responsabilités, en général des nombreuses parties prenantes concernées par les accidents de transport. Tout en reconnaissant que cette liste n'est certainement pas exhaustive, quelques uns des rôles et des responsabilités spécifiques au transport sont présentés ci-après. Il a été souligné que ces rôles et responsabilités doivent être précisés, même s'ils varient d'un pays à l'autre.

(a) Les pouvoirs publics devraient, entre autres :

- Prendre des décisions en matière d'usage du sol pour l'implantation des nouvelles routes et les aménagements autour des voies existantes utilisés pour le transport de marchandises dangereuses et prendre en compte les exigences relatives au transport de marchandises dangereuses lors de la planification de routes nouvelles et des installations annexes. Ces décisions devraient tenir compte des évaluations de l'impact sur l'environnement, y compris des analyses spécifiques, de l'état des connaissances, du risque pour de tels transports ;

- Affiner, améliorer ou adopter des lois et réglementations adéquates applicables au transport des marchandises dangereuses. En outre, il faudrait fournir des directives pour la mise en pratique de ces lois et réglementations. Il a été noté que l'expérience de l'industrie en matière d'initiatives dans ce domaine peut servir de base à de telles lois, réglementations et directives ;

- S'assurer qu'il existe un système adéquat de compensation qui s'applique aux victimes des accidents de transport impliquant des marchandises dangereuses ;

- S'assurer de la compétence des transporteurs en matière de manipulation de marchandises dangereuses et de minimisation des conséquences éventuelles des accidents de transport. Ceci peut se faire par exemple par le biais de spécifications relatives à la formation des conducteurs, de systèmes de permis ou de notification, et/ou des restrictions spatiales ou temporelles visant le trafic de marchandises dangereuses ;

- Surveiller et inspecter les transporteurs de marchandises dangereuses ainsi que les installations fixes associées à leur transport susceptibles de comporter des risques d'accidents comme les gares de triage et points de transbordement ;

- Analyser les accidents de transport importants impliquant des marchandises dangereuses ;

- S'assurer de l'existence de services efficaces de police, de pompiers et autres services indispensables en cas d'accident de transport.

(b) Les chargeurs devraient, entre autres :

- Mettre à la disposition des transporteurs et des clients l'information et les instructions nécessaires permettant de manipuler en sécurité les marchandises dangereuses ;

- Fournir un moyen d'obtenir des informations supplémentaires en cas d'urgence ;

- Etablir des systèmes pour vérifier la compétence des transporteurs ;

- Etablir des systèmes pour vérifier la conformité du système véhicule/équipement ;

- Echanger des informations relatives à la prévention, l'état d'alerte et la réponse aux accidents de transport ;

- S'assurer qu'ils seront avertis en cas d'incident significatif durant le transport.

(c) Les transporteurs devraient, entre autres :

- Assurer la sélection et l'entretien de l'équipement adéquat ;

- S'assurer que les employés sont compétents et convenablement formés et instruits pour les tâches qui leur sont confiées ;

- Assurer la mise à jour continue de procédures écrites d'exploitation ;

- Eviter dans la mesure du possible la sous-traitance car elle peut compromettre la sécurité ;

- Coopérer avec les chargeurs pour améliorer la sécurité et, à cet égard, informer les chargeurs de tout incident.

(d) Les clients devraient, entre autres :

- S'assurer qu'ils disposent de l'information adéquate pour manipuler en toute sécurité les marchandises dangereuses ;

- S'assurer que les employés sont compétents, et convenablement entraînés et formés à leurs tâches ;

- Informer les chargeurs et transporteurs de tout incident lors de la réception de marchandises dangereuses, par exemple, fuites ou conteneurs endommagés.

12. Les diverses parties impliquées dans le transport de marchandises dangereuses doivent coopérer pour remplir leurs différents rôles et responsabilités. Si dans le paragraphe précédent, des exemples ont été donnés sur la manière dont ces rôles et responsabilités peuvent se répartir, il faut noter que leur affectation peut différer quelque peu en fonction du pays et des caractéristiques de la situation.

13. L'erreur humaine de la part du conducteur a été mentionnée comme une cause contributive dans de nombreux accidents de la route qui impliquent des marchandises dangereuses et de nombreux efforts se sont concentrés sur l'amélioration de la performance du conducteur comme moyen d'augmenter la sécurité. Il a toutefois été reconnu que le conducteur ne devait être traité que comme un élément du système global de gestion conducteur-véhicule pour la prévention des accidents de transport. Il faudrait entreprendre des efforts pour réduire le risque dans l'ensemble du système. D'une manière générale, la nécessité

d'une formation et d'une instruction adaptées ont été fortement soulignées et les approches appliquées à cette formation ont été développées.

14. Il a été noté que les initiatives d'auto-régulation provenant de l'industrie comme les programmes <<responsible care>> correspondent à une norme de performance et des codes de pratique qui fournissent des orientations pour le transport des marchandises dangereuses.

Quelques aspects économiques

15. Les participants à la réunion ont reconnu la nécessité d'appliquer le principe du pollueur-payeur pour le transport de marchandises dangereuses y compris, par exemple, l'identification du <<pollueur>> en cas d'accident. On a fait remarquer à ce propos que, dans certains pays, des efforts portent sur le renforcement de la responsabilité de l'industrie, y compris des transporteurs, en matière d'internationalisation des coûts liés à la sécurité et à l'environnement du transport, ainsi que les coûts consécutifs à la réponse immédiate, au nettoyage et à la remise en l'état en cas d'accident. Ceci se fait par le biais par exemple d'incitations économiques et autres moyens de même nature. Il a également été noté que la réduction de la probabilité d'avoir des coûts importants de réponse et nettoyage, grâce à des méthodes de prévention et d'atténuation, pouvait constituer un avantage important à mettre en balance avec les coûts d'introduction de telles méthodes. Des recherches complémentaires portant sur ces questions économiques devraient être entreprises avec l'OCDE.

16. Il a été reconnu qu'il faudrait mettre en place des moyens permettant l'indemnisation des victimes des accidents y compris les coûts des effets nocifs sur la santé humaine, les biens matériels et l'environnement. Les systèmes actuels, y compris les dispositifs d'assurance ne se sont pas révélés parfaitement adaptés. La convention relative à la responsabilité civile pour les dommages causés pendant le transport de marchandises dangereuses par la route, le rail et les moyens de navigation intérieure (CRTD), qui n'a été ratifiée que par un seul pays Membre de l'OCDE constitue une tentative de règlement de ce problème au niveau international. En ce qui concerne l'indemnisation et l'assurance, plusieurs questions importantes ont été posées telles que la possibilité de fixer une limite aux dommages, la définition du responsable et sa couverture par une assurance ; et la nécessité pour les tarifs de refléter les risques réels.

17. De nombreuses propositions ont porté sur une harmonisation plus poussée, entre pays Membres de l'OCDE, des règles et politiques relatives au transport de marchandises dangereuses afin d'éviter les entraves au commerce et réduire les coûts. Il a été noté que dans la CE, tous les efforts possibles sont faits pour harmoniser la réglementation des différents Etats Membres afin d'éviter les entraves à la libre circulation du transport.

18. Il a été reconnu que l'harmonisation rencontrait certains obstacles comme des questions politiques ou la résistance de la part de certains secteurs industriels qui se sont déjà adaptés à certains systèmes existants. Il a été noté que l'harmonisation ne devrait se traduire dans aucun pays par un niveau réduit de sécurité et de protection de l'environnement.

19. Les questions de responsabilité limitée et de responsabilité en général ainsi que de savoir à qui il incombe d'agir ont été examinées. Il a été reconnu que si des différences existent d'un pays à l'autre, il faut savoir clairement qui est responsable en cas d'accident et à qui il incombe de prendre certaines mesures. Par exemple, en ce qui concerne l'imprévu lié à la planification, certains pays font porter la responsabilité aux chargeurs car ils disposent du maximum d'informations sur les marchandises dangereuses, tandis que dans d'autres pays, elle incombe à celui qui est en possession des marchandises.

Modes de transport et itinéraires

20. Un certain nombre d'études ont cherché à comparer la sécurité des différents modes de transport des marchandises dangereuses -- route, rail et navigation intérieure. Il en résulte qu'aucun mode n'est en lui-même plus sûr qu'un autre. La sécurité du transport dépend du caractère de la substance transportée, de l'itinéraire spécifique emprunté et d'autres conditions locales ainsi que de facteurs comme les pratiques de gestion des entreprises impliquées dans le transport. Aussi, les décisions relatives au mode de transport devraient se prendre au cas par cas.

21. De plus, l'accent a été mis sur l'intégration des décisions relatives aux modes et itinéraires de transport dans un processus de prise de décision plus large, qui prend en compte la sécurité et d'autres considérations environnementales (par exemple pollution chronique de l'air et de l'eau). De telles décisions doivent également prendre en considération l'opinion publique, par exemple les fortes réactions du public à des accidents avec d'importants effets sur la santé publique et l'environnement. Les décisions relatives aux modes et itinéraires de transport pour les marchandises dangereuses doivent être prises explicitement, après un examen complet de ces divers facteurs. Il a été jugé essentiel d'améliorer la compréhension des décisions relatives aux risques au niveau du public et d'améliorer la participation de celui-ci à la prise de telles décisions.

22. Il a été noté un recours accru au transport intermodal pour les mouvements de marchandises dangereuses. Les avantages au plan de l'environnement sont considérés comme un élément-clé de la décision de favoriser le transport intermodal. Néanmoins, un certain nombre de facteurs associés au transport intermodal ont été cités comme susceptibles d'accroître le risque de tels transports, comme :

- La multiplicité des partenaires, y compris les sous-traitants, impliqués dans ces transports rendant délicate une délimitation claire des responsabilités ;

- La manipulation plus fréquente des marchandises dangereuses et la nécessité éventuelle de stockage temporaire imposent des soins tout particuliers aux interfaces ; et

- Le fait que le conteneur des marchandises soit soumis à des conditions qui peuvent différer de celles prévues lors de ses conception et réalisation. A cet égard, il a été noté que des efforts sont faits pour traiter ce problème, en développant par exemple des conteneurs isolés sur le plan thermique.

En conséquence, les évaluations du risque devraient prendre en compte les différents facteurs impliqués. Il est clair qu'il faut plus de recherches sur les risques et technologies associés au transport intermodal de marchandises dangereuses.

Tunnels

23. Bien qu'il ait été noté que le public pense en général qu'il faut éviter le transport de marchandises dangereuses dans les tunnels, les analyses du risque des variantes d'itinéraires indiquent qu'un itinéraire empruntant un tunnel peut s'avérer plus sûr qu'une variante en surface. En conséquence, il faut mener de telles analyses en reconnaissant que les tunnels selon leur type et leur taille ont des implications différentes en matière de sécurité. Il faut donc fournir des informations sur les analyses et favoriser des débats publics sous une forme appropriée.

24. Il faudrait mener des analyses du risque concernant le transport de marchandises dangereuses pour les tunnels existants comme pour ceux en projet. Dans le premier cas, les analyses sont un élément important des décisions de gestion tandis que dans le second, ces analyses sont importantes pour les aspects liés à la conception et à la planification. Les analyses du risque devraient prendre en compte les problèmes spécifiques relatifs à l'action des brigades de sapeurs-pompiers dans les tunnels. Des recherches complémentaires sont nécessaires pour donner à ces analyses l'efficacité requise.

25. Il a été proposé que l'OCDE puisse, en coopération avec d'autres organisations internationales compétentes, entreprendre des recherches et analyses du risque concernant une sélection de tunnels routiers existants afin de déterminer quels sont les principes communs qui peuvent être retenus pour améliorer la prévention et l'état d'alerte et la réponse aux accidents du transport ainsi que recommander des améliorations en termes de conception géométrique, entretien et utilisation de nouvelles technologies.

26. Il a été noté qu'à de nombreux égards, les analyses du risque pour les tunnels sont tout aussi complexes que celles des installations fixes et qu'il faudrait, chaque fois que cela est possible, tirer parti de l'expérience acquise avec les analyses du risque liés aux installations fixes.

27. L'accent a été mis sur la nécessité de développer des plans pour parer à l'imprévu et de mener des exercices pour tester ces derniers plans afin d'être capable de réagir efficacement aux accidents qui impliquent des marchandises dangereuses dans les tunnels.

Etat d'alerte et réponse aux urgences

28. Les participants ont examiné les différents systèmes volontaires dans l'industrie pour apporter information et assistance sur le lieu d'un accident, comme Chemtrec et les Centres Européens de Réponse Nationale coordonnés dans le projet ICE. Il a été reconnu que ces systèmes constituent un bon exemple de coopération industrie-gouvernement et offrent un moyen efficace de diffuser l'information et l'assistance nécessaires à partir de l'industrie qui dispose de l'information la plus complète et la plus fiable.

29. En ce qui concerne le besoin d'informations fiables et rapides sur la substance qui peut se trouver impliquée dans un accident, les participants à la réunion ont fait remarquer que la situation n'est pas toujours satisfaisante. Par exemple, des panneaux peuvent avoir été détruits par le feu ou avoir été intentionnellement enlevés. En outre, les conducteurs peuvent ne pas être informés sur les

marchandises transportées ou ne pas être capable de fournir l'information à des services de réponse d'urgence. On a décrit d'autres moyens de fournir cette information comme des systèmes de haute technologie, émetteurs et ordinateurs par exemple.

30. Un accord s'est dégagé sur l'idée que les planificateurs doivent être des <<visionnaires>>, lorsqu'ils développent des systèmes pour fournir l'information requise par les services de réponse d'urgence. A cet égard, ils devraient tenter de développer de nouveaux systèmes plus fiables. Toutefois, deux précautions ont été rappelées. En premier lieu, ces nouveaux systèmes devraient être harmonisés dès leur développement, afin de prévenir l'utilisation de systèmes incompatibles dans des zones différentes. En second lieu, les coûts et contraintes techniques peuvent signifier des retards dans la mise en oeuvre de tout nouveau système. En attendant, il faut encourager une large mise en oeuvre et un large contrôle du respect des systèmes existants et la poursuite de leur harmonisation.

31. La manière d'obtenir des directives sur les toutes premières actions que doivent prendre les services de réponse d'urgence sur le lieu d'un accident dans les minutes qui suivent, a fait l'objet d'une autre discussion. Les différentes approches ont été présentées, y compris les guides utilisés en Amérique du Nord et les <<Code d'Action d'Urgence>> employés au Royaume-Uni. Des études complémentaires devraient être entreprises sur l'efficacité des différents systèmes et les moyens possibles de les harmoniser.

32. Certains orateurs ont indiqué une tendance à la prolifération des systèmes de classification et d'étiquetage des marchandises dangereuses. Les participants à la réunion ont vivement appuyé les efforts en cours en vue d'harmoniser ces systèmes sur le plan international.

33. Il est nécessaire d'étendre la planification d'urgence préalable aux incidents pour le transport des marchandises dangereuses, en donnant la priorité aux corridors et aux marchandises à haut risque. Le concept du droit au public de savoir devrait être appliqué pour le transport, en reconnaissant qu'il peut s'avérer nécessaire d'adapter les principes appliqués aux installations fixes.

34. Le rôle du personnel des services de secours a été discuté. Il a été admis qu'il faut former le personnel des services de secours à la compréhension des risques associés au transport de marchandises dangereuses. De plus, il a été reconnu que lorsqu'on établit des exigences et politiques relatives au transport de marchandises dangereuses, il faut tenir compte de la disponibilité et de la nature des services d'urgence. A cet égard, les décideurs devraient, lors de la mise au point de telles exigences et politiques, rechercher l'apport de toutes les parties intéressées, y compris le personnel des services d'urgence.

35. La nécessité d'éduquer et de former efficacement les personnels de lutte contre l'incendie et des autres services de secours en plus du besoin d'une information au moment de l'accident ont été soulignés. A cet égard, l'expérience acquise en matière d'éducation et de formation liées à l'état d'alerte et à la réponse aux urgences dans le cas des installations dangereuses devrait être appliquée au transport de marchandises dangereuses. Il a été noté que, dans certains pays, la police et le personnel médical de premiers secours ou les pompiers bénévoles sont ceux qui arrivent les premiers sur les lieux mais qu'ils n'ont pas été formés convenablement sur la manière de traiter les marchandises dangereuses. En outre, on a noté la

nécessité du suivi de la formation, en considérant notamment que les accidents qui impliquent des marchandises dangereuses, s'ils sont rares, peuvent avoir des conséquences graves.

36. Certains pays ont tiré profit de l'utilisation de fuites réelles de substances chimiques dans le cadre de la formation des personnels de lutte contre l'incendie et des services de secours, en plus d'autres types de formation. Il devrait y avoir une mise en commun plus avant au niveau de l'information et de l'expérience acquises grâce à ce genre de formation, avec en particulier les pays ne disposant pas de moyens d'entreprendre ces exercices de formation.

37. Il a été noté que le traitement des accidents nécessite des activités qui vont au-delà de la réponse immédiate. Des travaux complémentaires relatifs au nettoyage et à la remise en état à la suite d'un accident constituent une exigence.

Autres

38. Il a été noté que l'approche employée pour la gestion de la qualité peut s'avérer une manière intéressante d'améliorer la sécurité du transport de marchandises dangereuses. Il a été admis que le système défini par les normes pertinentes de la série ISO 9000 doit être complété par un ensemble spécifique d'objectifs relatifs à la sécurité comme il a été proposé aux organismes internationaux de normalisation.

39. Il a été proposé de développer un moyen d'améliorer l'échange au plan international d'informations et d'expériences relatives à la recherche-développement en matière de transport de marchandises dangereuses. A ce propos, l'intérêt des échanges d'informations sur les résultats de recherche pour la définition des projets futurs dans ce domaine a été souligné.

40. Il a été souligné que tous travaux futurs entrepris par l'OCDE relatifs au transport de marchandises dangereuses devraient prendre en compte toutes les autres activités internationales dans ce domaine. Des efforts devraient être accomplis afin d'éviter les doubles emplois dans les secteurs où les recommandations présentées peuvent concerner des initiatives et des travaux en cours dans d'autres organismes internationaux.

41. Il a été noté que les pays Membres devraient faire des efforts supplémentaires pour se conformer aux accords et recommandations développés par les organisations internationales dans ce domaine.

Introduction

This Environment Monograph contains documents from an OECD Workshop on Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection, hosted by the Swedish authorities in June 1992 in Karlstad, Sweden. It is one of a series of Environment Monographs that have been published as part of the OECD Environment Programme's work on improving chemical accident prevention, preparedness and response.

OECD work on chemical accidents began in 1988, in response to a call by Ministers and other high-level officials at the OECD Conference on Accidents Involving Hazardous Substances. To supervise this work, an ad hoc Group of Experts on Accidents Involving Hazardous Substances was established. The Group's mandate has recently been extended, and its name changed to the Expert Group on Chemical Accidents.

The objectives of the Chemical Accidents Programme include: the exchange of information and experience; the analysis of specific issues of mutual concern in Member countries; and the development of guidance materials related to chemical accident prevention, preparedness and response. As a contribution to meeting these objectives, several Workshops have been held, including five that took place between 1989 and 1991.[1] These Workshops brought together representatives of public authorities, industry, labour, public interest groups, academia, and other international organizations, including experts from non-OECD countries, providing an opportunity for exchange of information and experience. In addition, the output from the workshops has been used as a basis for the development of guidance documents and, in particular, the OECD *Guiding Principles for Chemical Accident Prevention, Preparedness and Response.*[2]

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[1] See Environment Monograph No. 28, *Workshop on Prevention of Accidents Involving Hazardous Substances: Good Management Practice*, hosted by the Federal Republic of Germany (Berlin, 1989); Environment Monograph No. 29, *Workshop on the Provision of Information to the Public and on the Role of Workers in Accident Prevention and Response*, hosted by Sweden (Stockholm, 1989); Environment Monograph No. 30, *Workshop on the Role of Public Authorities in Preventing Major Accidents and in Major Accident Land Use Planning,* hosted by the United Kingdom and the Netherlands, supported by the Commission of the European Communities (London, February 1990); Environment Monograph No. 31, *Workshop on Emergency Preparedness and Response and on Research in Accident Prevention, Preparedness and Response*, hosted by the United States and Canada, co-sponsored by the United Nations Environment Programme (Boston, May 1990); and Environment Monograph No. 44, *Workshop on Prevention of Accidents Involving Hazardous Substances: The Role of the Human Factor in Plant Operations*, hosted by Japan (Tokyo, April 1991).

[2] Environment Monograph No. 51, *Guiding Principles for Chemical Accident Prevention, Preparedness and Response: Guidance for Public Authorities, Industry, Labour and Others for the Establishment of Programmes and Policies related to Prevention of, Preparedness for, and Response to Accidents Involving Hazardous Substances*, 1992.

The Workshop on Strategies for Transporting Dangerous Goods by Road was a joint activity of two parts of the OECD: it was sponsored by the OECD Road Transport Research Programme, in co-operation with the Expert Group on Chemical Accidents. This Workshop was one of a series of activities planned by the Expert Group in the area of transport of hazardous goods, with a view to developing guiding principles related to the interface of various transport modes to complement the existing OECD Guiding Principles, which focus on fixed installations.

Included in this Environment Monograph are the conclusions of the Workshop, setting out the points discussed at the Workshop on which the participants agreed there was a general consensus. Also included is the Discussion Document, prepared by a consultant to the OECD for use as a starting point for discussions at the Workshop and revised subsequently to reflect the Workshop's outcome.

It should be kept in mind that the documents in this Environment Monograph have not been endorsed by, and do not necessarily reflect the views of, the OECD or its Member countries.

The Expert Group on Chemical Accidents decided to publish this Monograph in order that the two Workshop documents presented here could be circulated widely.[3] The Expert Group would welcome feedback on these documents from as many interested parties as possible. Comments received will be taken into account in the development of guidance materials, in order that they can be as practical and up-to-date as possible.

Anyone wishing to comment on the documents contained in this publication should directly contact their country's representative to the OECD Expert Group on Chemical Accidents. A list of Heads of Delegations to the Expert Group will be found at the end of this Monograph. Those who wish to comment but do not come from an OECD country, or whose country is not included in the list of Heads of Delegation, are requested to send their comments to:

OECD Environment Directorate
Environmental Health and Safety Division
2, rue Andre-Pascal
75775 Paris Cedex 16
FRANCE

FAX: (33-1) 45 24 16 75

[3] A publication containing all the papers presented at the Workshop, as well as the Workshop conclusions, is in the process of being prepared by the Swedish authorities. It will be available from the OECD in mid-1993.

Part One

Conclusions of the OECD Workshop on Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection

The OECD Workshop on Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection was held on 2-4 June in Karlstad, Sweden. The Workshop was attended by approximately 100 participants from 16 countries as well as from the Commission of the European Communities. In addition to representatives from national and local governments, there were participants from academia, industry and workers' organizations. Unfortunately, the ECE was unable to send a representative. Over 35 papers were presented. The meeting was organized by the Swedish authorities, in co-operation with the OECD Road Transport Research Programme and the OECD Environment Directorate.

The Workshop addressed numerous issues related to the prevention of, preparedness for and response to transportation accidents involving dangerous goods. A basic premise of the meeting was that the objective of all stakeholders should be to prevent such accidents, but that "it is likely that something unlikely will happen" (Aristotle). With this in mind, the meeting reached the following conclusions:

Information and Statistics

1. There is a need for the collection of better information and statistics related to: the extent and nature of the transport of dangerous goods; and transport accidents involving such goods. Such information and statistics should be made available and shared amongst policymakers concerned with transport accidents in order to learn lessons for accident prevention and emergency planning. Efforts should be made to facilitate sharing of information and experience within countries and internationally, for example by developing an international scheme for the collection of relevant information and statistics and/or by harmonizing the nature of the information collected, and the form in which it is collected.

2. It was noted that the collection of comprehensive information on *all* dangerous goods transport is a complex task and could require considerable resources and outlay, not available in many countries. However, the necessary information for making decisions about accident prevention and emergency response may be obtainable by using appropriate sampling methods for data collection. It was agreed that caution is needed in the interpretation of information related to the transport of dangerous goods, recognizing that the

premises used in information collection as well as the means used for collecting information can affect its interpretation.

3. It was recognized that, in most cases, potential human health and property effects are used to define "dangerous goods" for purposes of controlling transport of such goods and for collecting information on dangerous goods transport and on transport accidents. Further work needs to be done to examine the issue of environmental effects, to determine which types of goods may have significant environmental effects when released during a transport accident, to review existing information, and to obtain better information concerning the nature and extent of the transport of such goods. The difficulties in collecting such information were noted. For example, collection of information related to environmental effects is complicated by the need to consider the media into which the dangerous goods are released, the extent of the persistency of the goods, etc.

Risk Analysis

4. Risk analysis is an important tool for prevention of, and preparedness for, transport accidents. Risk analyses can be used as one input in the decision-making process related to, for example, comparisons of various modes of transport and of alternative routings of dangerous goods traffic, as well as for decisions concerning vehicle and tank design. In this regard, it was noted that in some countries quantitative risk assessment ("QRA") has proved to be useful in making decisions on aspects of accident prevention and emergency planning such as physical planning and routing of transport vehicles. QRA allows relative ranking of risks and provides an aid for determining appropriate preventive measures.

5. Current risk analyses focus primarily on risks to human health in general. Whilst these are a major concern in most cases, consideration should also be given to other aspects, notably risks to the environment. To assess and balance such risks together with risks to human health, where appropriate, it will be necessary to develop assessment methods which can be broadly accepted.

6. It should be noted that currently data relating to accidents in connection with transport of dangerous goods is scarce. As a consequence, risk analysis, when applied to such transport, must rely on a number of assumptions and should not be taken to forecast the probability of accidents without recognizing its limitations. Nevertheless, when applied to alternative routes for a given transport requirement, risk analyses may offer a reasonably accurate evaluation of relative risks.

7. It was agreed that the existing international systems for grouping dangerous chemicals solely by hazard class are not appropriate for assessing accident information or for carrying out risk analyses related to transport accidents involving dangerous goods. More chemical-specific information, such as the UN substance identification number, is needed for such assessments and analyses.

8. Additional work is needed to better understand the differences among risk analysis methods, the limitations of such methods, the level of confidence in the results, and how best to use risk analyses. In this regard, it was noted that further work should be undertaken by an appropriate international organization related to developing a better understanding of risk analysis methodologies and applications, including data requirements and criteria, used in Member countries. This work should be comprehensive, reflecting the full range of economic, environmental, public health and other factors associated with the transportation of dangerous goods by all modes (inland waterways, rail and road).

9. Any work undertaken with respect to risk analyses of transport accidents should avoid duplicating work undertaken in related areas and, in this regard, any new work in this area should build upon the experience gained from risk analyses of fixed installations. Lessons learned with respect to such risk analyses can be usefully applied in the analyses of transport of dangerous goods for which there is less experience. The basic techniques used for fixed installations and for transport will be the same but the application of these techniques to transport is not as well developed in light of, for example, the need to define the nature and extent of possible exposure for a dispersed population, traffic congestion, etc. It was noted that the concepts of individual risk and societal risks are relevant to fixed installations but that for road transport, in particular, individual risk is generally low and, therefore, the concept of societal risk is of greater concern except in some specific areas.

10. A methodology for predicting future costs of transport accidents was described, based on an intensive study of the consequences, and known costs (including costs to municipalities, industry, etc.) of a limited number of representative accidents. While providing a valuable tool for decision-making, it was recognized that the various costs will differ significantly among countries and regions as a result of local conditions including legal infrastructure, road systems, etc. Further work should be undertaken in the area of quantification of costs associated with transport accidents.

Roles and Responsibilities of Stakeholders

11. There was significant discussion concerning the general roles and responsibilities of public authorities as well as various sectors of industry (such as manufacturers, shippers, transporters, etc.), including management and workers. Reference was made to the OECD Guiding Principles for Chemical Accident Prevention, Preparedness and Response. This document relates primarily to fixed installations, but it also indicates the general roles and responsibilities of the many stakeholders concerned with transport accidents. The following were noted as some of the transport-specific roles and responsibilities although it was recognized that this list is certainly not exhaustive. It was emphasized that these roles and responsibilities have to be specified, even if they vary from one country to another.

(a) Public authorities should, *inter alia*:

- make land use planning decisions concerning the siting of new roadways and developments near existing roadways used for dangerous goods transport and take into account requirements related to the transportation of dangerous goods when planning new roads and related facilities. These decisions should take into account environmental impact assessments, including specific, state of the art, risk analyses for such transport;

- refine, improve or adopt appropriate laws and regulations related to the transport of dangerous goods. In addition, guidance for the practical implementation of such laws and regulations should be provided. It was noted that the experience with industry initiatives in this area can provide a basis for such laws, regulations and guidance;

- ensure that an adequate compensation system exists applicable to victims of transport accidents involving dangerous goods;

- ensure the competency of carriers to handle dangerous goods and to minimize the possible consequences of transport accidents. This could be done through, e.g., driver training specifications, permitting or notification systems, and/or time and place restrictions on dangerous goods traffic;

- monitor and inspect dangerous goods carriers as well as fixed locations associated with dangerous goods transport which may pose risks of accidents. This could include warehouses, marshalling yards and transfer points;

- investigate significant transport accidents involving dangerous goods;

- ensure that there exists adequate police, fire brigades and other emergency services necessary in the event of a transport accident.

(b) Consignors should, *inter alia*:

- provide to carriers and to customers information and necessary instructions to enable safe handling of the dangerous goods;
- provide a means of obtaining additional information in the event of an emergency;
- establish systems for screening and/or reviewing the competence of carriers to maintain an appropriate level of safety;
- develop systems for screening and/or reviewing vehicle and equipment suitability;
- exchange information concerning transport accident prevention, preparedness and response;
- ensure that they are notified in the event of any significant incident during transport.

(c) Carriers should, *inter alia*:

- ensure the selection and maintenance of appropriate equipment;
- ensure employees are competent, and adequately trained and educated for their tasks;
- maintain written operating procedures;
- avoid subcontracting, as far as possible, if this would compromise safety;
- co-operate with consignors to improve safety and, in this regard, inform consignors of any incidents.

(d) Customers should, *inter alia*:

- ensure that they have adequate information for the safe handling of the dangerous goods;
- ensure that employees are competent, and adequately trained and educated for their tasks;
- inform consignors and carriers of any incidents during receipt of the dangerous goods, such as leaking or damaged containers.

12. The various parties involved in the transport of dangerous goods must co-operate in fulfilling their various roles and responsibilities. Whereas the previous paragraph provides examples of how these roles and responsibilities are generally allocated, it should be noted that the allocation may differ somewhat among countries and specific situations.

13. Human error by the driver has been noted as a contributing cause in many road accidents involving dangerous goods and much effort has been focused on improving driver performance as a way to increase safety. However, it was recognized that the driver should be treated as just one element in an overall driver-vehicle-management system for preventing transport accidents. Efforts should be undertaken to reduce risks in the system as a whole. As a general matter, the need for appropriate training and education was strongly emphasized and the approaches used for such training were described.

14. It was noted that industry-driven, self-regulatory initiatives, such as Responsible Care programmes, set out a standard of performance and codes of practice which provide guidance related to the transport of dangerous goods.

Some Economic Aspects

15. The Workshop recognized the need for the application of the "Polluter Pays Principle" with respect to the transport of dangerous goods, noting the particular problem of determining who is the "polluter". In this regard, it was noted that, in some countries, efforts are being made towards increased internalization by industry, including carriers, of safety and environmental costs of transport including the costs of immediate response as well as clean-up and restoration in the event of an accident. This is being done through the use of, for example, economic incentives and other economic instruments. It was also noted that reducing the likelihood of the scale of response and clean-up costs, through prevention and mitigation methods, could be a significant benefit to set against any costs from introducing such methods. Further research should be undertaken within the OECD with respect to such economic issues.

16. It was agreed that means should be in place for the compensation of victims of accidents including costs of adverse effects on human health, property and the environment. The current systems, including insurance schemes, have not always proven to be fully adequate. One attempt to address this problem, at an international level, is the Convention on Civil Liability for Damage Caused during the Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD), which has only been ratified by one OECD Member country. With respect to compensation and insurance, several outstanding issues were noted including: the possibility of fixing limits on damages; the determination of who is responsible for obtaining insurance; and the need for rates to reflect actual risks.

17. Numerous suggestions were made for increased harmonization among OECD Member countries with respect to rules and policies related to transport of dangerous goods in order to, *inter alia*, avoid barriers to trade and reduce costs. It was noted that in the EC every effort is being made to harmonize the legislation of different Member States in order to avoid barriers to free circulation of transport.

18. It was recognized that there are some obstacles to harmonization, including political questions, as well as resistance on the part of some industrial sectors which have already adapted to certain existing systems. It was noted that harmonization should not result in a reduced level of safety and environmental protection in any country.

19. In a related matter, the issues of liability and responsibilities for taking action were discussed. It was recognized that while differences exist among countries, it should be clear which party is liable in the event of an accident and who has responsibility for taking certain actions. For example, with respect to contingency planning some countries put a responsibility on shippers, who have the most information concerning the dangerous goods, while others impose responsibility on the party in possession of the goods.

Modes of Transport and Routing

20. A number of studies have been undertaken comparing the safety of the various modes of transport for dangerous goods — road, rail and inland waterway. These have indicated that no one mode is generically more safe than another. The safety of transport is dependent upon the specific substance being transported, the specific route being used and other local conditions as well as upon factors such as management practices of the enterprises involved in the transport. Therefore, decisions on transport mode should be case-specific.

21. Furthermore, it was emphasized that decisions concerning transport modes and routes are part of a broader decision-making process, taking into account other safety and environmental considerations (e.g. chronic pollution of air and water) as well as other relevant factors. Such decisions also need to take into account public perceptions, for example the public's strong reaction to accidents with extensive health and environmental effects. Decisions concerning transport modes and routes for dangerous goods should be made explicitly, after informed consideration of these various factors. It was considered essential to increase public understanding of decisions related to risks and to improve public input into such decision-making.

22. It was noted that there is an increasing use of intermodal transport for the movement of dangerous goods. Environmental benefits are considered a key element in the decision to favour intermodal transport. However, a number of factors associated with intermodal transport were cited as possibly increasing the risk of such transport, including:

- the numerous partners, including subcontractors, involved in such transport make it difficult to have a clear delineation of responsibilities;
- the greater amount of handling of the dangerous goods and the possible need for temporary storage require special care at interfaces; and
- containers for dangerous goods are subject to conditions which may differ from those considered during their design and engineering. In this respect, it was noted that efforts are being made to address this problem by, for example, developing thermally insulated containers.

Consequently, risk assessments should be done, taking into account the various factors involved. More research is clearly needed on the risks and technologies associated with intermodal transport of dangerous goods.

Tunnels

23. It was noted that while the public perception is generally that transport of dangerous goods in tunnels should be avoided, in fact risk analyses of routing alternatives indicate that a tunnel route may be safer than an above-ground alternative. Consequently, such analyses need to be done, recognizing that different types and sizes of tunnels have different safety implications. Information on the analyses should be provided to the public, and appropriate public discussions should be encouraged.

24. Risk analyses related to the transport of hazardous goods should be undertaken for both existing and proposed tunnels; in the former case, the analyses are an important input in management decisions, while in the latter such analyses are important for design and planning considerations. The special problems for fire brigades working in tunnels should be taken into account in the risk analyses. Additional research is required in order to be able to perform such analyses effectively.

25. It was suggested that the OECD could, in co-operation with other relevant international organizations, undertake research and risk analyses related to selected existing road tunnels to determine what common principles might be identified to improve prevention, preparedness and response for transport accidents and to recommend improvements in terms of layout, maintenance and use of new technologies.

26. It was noted that in many ways risk analyses of tunnels are similar in terms of complexity to those of fixed installations and, therefore, the experience gained with risk analyses of fixed installations should be applied, as appropriate.

27. The need for the development of contingency plans and for exercises to test such plans in order to be able to respond effectively to accidents involving dangerous goods in tunnels was emphasized.

Emergency Preparedness and Response

28. Participants discussed the various voluntary industry systems for providing information and assistance at the site of an accident, such as Chemtrec, as well as certain response centres in Europe co-ordinated through the ICE project. It was recognized that these systems are a good example of industry-government co-operation and provide an effective means for disseminating the necessary information and assistance from the industry which has the most extensive and reliable information.

29. With respect to the need for reliable, quick information about the substance which may be involved in an accident, the meeting noted that the current situation is not always adequate. For example, placards may be destroyed in fires or may have been purposefully removed. In addition, drivers may not be knowledgeable about the goods being transported or may not be physically able to provide information to emergency responders. Alternative means for supplying such information were described including high technology systems involving, for example, transmitters and computers.

30. It was agreed that planners should be "visionary" in developing systems to provide information required by emergency responders. In this regard, they should try to develop new, more reliable systems. However, two cautions were indicated. First, such new systems should be harmonized when they are being developed, in order to avoid the use of incompatible systems in different areas. Second, costs and technical constraints may mean delays in the implementation of any new systems. In the interim, broad implementation and enforcement of existing systems, and the further harmonization of existing systems, should be encouraged.

31. Further discussion was held on how to obtain guidance on first strike actions to be taken by emergency responders during the first minutes at the scene of an accident. The different approaches were described, including the guidebooks used in North America and the Emergency Action Codes used in the United Kingdom. Further study should be undertaken on the effectiveness of the various systems and possible means towards their harmonization.

32. Some speakers noted that there is a tendency towards a proliferation of systems for classification and labelling of dangerous goods. The meeting strongly supported ongoing international efforts to harmonize these systems.

33. Pre-incident emergency planning for transportation of dangerous goods needs to be expanded, with a priority given to high risk corridors and to high risk goods. The concept of public right to know should be applied with respect to transport, recognizing that the principles applied for fixed installations may need to be adapted.

34. The role of the rescue services personnel was discussed. It was agreed that rescue services personnel need to be trained to understand the risks associated with the transport of dangerous goods. Furthermore, it was recognized that, in developing requirements and policies related to the transport of dangerous goods, the availability and nature of rescue services need to be taken into account. In this regard, in developing such requirements and policies, the input of all relevant parties including the rescue services personnel should be sought by decision-makers.

35. The need for effective education and training of firefighters and other rescue personnel was underscored, in addition to the need for information at the time of an accident. In this regard, the experience gained in education and training with respect to emergency preparedness and response for hazardous installations should be applied to transport of dangerous goods. It was noted that in some countries, police and emergency medical personnel, or voluntary fire services, were first on the scene but have not been adequately taught how to deal with dangerous goods. Furthermore, the need to maintain training was noted, particularly in light of the fact that accidents involving dangerous goods, while rare in number, can have serious consequences.

36. Some countries have benefitted from the use of real life chemical releases in the training of fire and rescue services personnel, in addition to other types of training. There should be further sharing of information and experience gained from this type of training, in particular with those countries which may not have the capability to undertake such training exercises.

37. It was noted that the handling of accidents requires activities beyond the immediate response. Further work is needed related to clean-up and restoration following an accident.

Other

38. It was noted that the approach used for quality management was considered to be a valuable way to improve the safety of the transport of dangerous goods. It was agreed that the system defined by the relevant aspects of the ISO series 9000 has to be complemented by a specific set of objectives for safety, as has been proposed to international normalization organizations.

39. It was suggested that a means be developed for the improved international exchange of information and experience related to research and development concerning the transport of dangerous goods. In this regard, the value of exchanging information concerning proposed research activities, in order to better define the scope of the research, was noted in addition to the exchange of information concerning research results.

40. It was underscored that any further work undertaken by the OECD related to the transport of dangerous goods should take into account all other relevant international activities in this field, and that every effort be made to avoid duplication of work in those sectors where the present recommendations may concern initiatives and work underway in other international bodies.

41. It was noted that further efforts should be undertaken by countries in order to comply with relevant agreements and recommendations of international organizations.

Part Two

Revised Discussion Document: Transport of Dangerous Goods by Road

Prepared in conjunction with the Workshop on Strategies for Transporting Dangerous Goods by Road: Safety and Environmental Protection[1]

1. Introduction

The OECD, through its Environment Programme, has developed Guiding Principles for Chemical Accident Prevention, Preparedness and Response to provide guidance for public authorities at all levels, industry, employees etc. This guidance was the product of the first three-year programme of the OECD related to accidents involving hazardous substances, carried out in response to a call by Ministers and other high level officials at the OECD conference on such accidents held in February 1988.

The Guiding Principles were formulated in relation to accidents involving dangerous goods at fixed locations. A potential for similar accidents exists from the transport of dangerous goods. In general, similar guiding principles to those for fixed sites are likely to be relevant to transport activities, but in some areas significantly different guidance may be needed to reflect the very different nature of transport activities as compared to activities at a fixed installation.

In consequence, the OECD has established a project to develop guidance specific to the transport of dangerous goods, notably in respect of temporary storage facilities, transient stopping points (e.g. truck parking areas, railway marshalling yards) interfaces with fixed installations (e.g. loading and unloading points) and ports. Once appropriate guidance has been developed, it will need to be integrated with the Guiding Principles already developed, which focus on chemical accidents at fixed installations.

The OECD has a Road Transport Research (RTR) Programme, which centres on roads and road transport but takes account of the effect of other methods of transport and their interfaces with roads and road transport. This programme pursues technical and scientific activities to provide support to decision making by OECD Member countries and other international bodies. It also provides an assessment of future strategies in respect of

[1] This document was prepared by a consultant to the OECD, Dr. R.M. Turner, to be used as a basis for discussion at the Workshop. It was subsequently revised to reflect comments made at the Workshop. Similar documents have been prepared in conjunction with other Workshops, to be used in the preparation of an OECD guidance document for chemical accident prevention, preparedness and response (see the Introduction to this Environment Monograph). This Discussion Document does not necessarily reflect the views of the OECD or of its Member countries.

roads and road transport matters including priority policy concerns of Member countries. In addition, it assists in the worldwide exchange of information on road transport matters via the information and documentation programme (IRRD -- International Road Research Documentation).

The Workshop on "Transporting Dangerous Goods by Road: Safety and Environmental Protection" has been organized by the OECD Road Transport Research Programme in co-operation with the OECD Environment Programme's Expert Group on Chemical Accidents. It will bring together experts from relevant areas (e.g. transport, environment, health and safety) and therefore provide an opportunity for major input into the guiding principles for transport of dangerous goods to be developed by the Expert Group. In addition, the Workshop will identify those areas where more data is required or where further studies are needed as part of the Road Transport Research Programme.

This Workshop will build on the review of the problems and hazards of moving dangerous goods by road carried out in 1988 by an OECD expert group as part of the Road Transport Research Programme. It will also consider matters arising from the replies from Member countries to the questionnaire recently issued by OECD, and from individual presentations at the Workshop.

With these starting points in mind, the statistics of accidents involving the road transport of dangerous substances and methods of assessing the risks from this trade will be covered. In addition, the special case of the transport of goods through tunnels will be considered as will developments in policy for road transport, both proposed and potential. The key elements of the Workshop will be the reasonable practicability of the prevention of accidents from road transport and the development of appropriate emergency preparedness and response to mitigate the consequences of any accidents that do occur.

Consideration of accident prevention will involve discussion of matters such as the cost and benefits of preventing accidents, the value of designated routes for dangerous goods transport, improvements in vehicle design, the requirements of areas of special risk (e.g. ports, parking areas, interfaces between modes of transport etc.). Consideration will also be given to the role and responsibilities of those involved in the transport of dangerous goods (i.e. public authorities, manufacturers, owners, transporters and insurers) in the prevention of accidents. Discussion of emergency preparedness and response will address the responsibilities of the various agencies involved, as well as the practical aspects of responding to roadway accidents and including the availability of expert advice and information to those involved in the emergency response.

The potential for large scale serious consequences to people and the environment from an accident involving dangerous goods is clear, but such large scale events are rare and in general arise as a result of general road accidents rather than the inherent nature of dangerous goods. In consequence, any measures which improve general road safety will also improve the safety of dangerous goods transport. However, the potential of dangerous goods to expose large numbers of people to harm and pose a threat of serious damage to the environment gives rise to particular concerns and the need for specific measures to minimize the risk of such events occurring.

There is a considerable amount of guidance on safety aspects of road transport of dangerous goods, and a large body of national and international rules and regulations, but serious accidents still occur. Hence there is a need to pursue measures to increase the safety of road transport. However, in view of the importance of road transport to the economies of most countries and the low likelihood of major accidents involving dangerous goods occurring, it would not usually be appropriate to pursue safety improvements at any cost. The cost of any risk reduction measure should be taken into account to ensure that it is not in too great a disproportion compared to the benefit to be gained.

It is vital therefore to consider appropriate measures to improve safety in the road transport of dangerous goods and to assess which of these would be the most cost effective in ensuring that the risk of harm to people and the environment from such transport is made as low as is reasonably practicable.

The OECD projects need to take account of this and seek to minimize duplication of effort by developing complementary programmes of work and advice with bodies such as the United Nations and the European Community.

2. General Comments on Current Guidance and Regulations

2.1 United Nations recommendations

The UN recommendations derive from the recommendations of the UN Committee of Experts on the Transport of Dangerous Goods (the "Orange Book" Committee), which reports to the United Nations Economic and Social Council (ECOSOC). The Committee of Experts meets every two years to update its recommendations.

The recommendations cover the classification, labelling and packaging of dangerous goods and have been extensively used as the basis for international agreements covering air, sea and rail transport as well as road transport. These recommendations also play a major role in most countries' national guidance, practices and regulations. For sea and, particularly, air transport the recommendations are followed rigorously, but for road and rail transport there are some variations to take account of specific national concerns as well as differences with other international agreements.

It is important to note that the UN recommendations do not address general transport policy aspects or such matters as emergency preparedness and response, routing, management systems etc., nor do they provide for monitoring or enforcement procedures. Such matters are left for individual governments to decide.

2.2 The European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)

This agreement, formulated in 1947, was initially based on a system of rules agreed between the European railway companies for the International Carriage of Dangerous Goods by Rail (RID), which originated in 1893. The ADR agreement was therefore initially completely separate from the UN recommendations. However it has been revised over the years, as have the UN recommendations, and there is now much closer agreement although complete harmonization has not yet been achieved. ADR is administered through the Inland Transport Committee of the United Nations Economic Commission for Europe (ECE) and, as with the UN recommendations, it is usually updated every two years.

The intention of ADR is to ensure that dangerous goods, including wastes, being carried by road are able to cross international frontiers provided that the substances concerned have been safely packed and are being safely carried. The agreement therefore contains provisions for packaging, labelling and vehicle standards. It also stipulates a requirement for driver training and the information that must be carried by the driver during the journey. This latter includes i) a transport document containing a description of the dangerous goods and the ADR item number; ii) information displayed in the cab about the risks from the goods and emergency instructions for the driver; iii) an appropriate certificate of approval for the vehicle issued by the competent authority for ADR in the country of registration; and iv) in the case of a tank vehicle, an appropriate training certificate for the driver.

The requirements of ADR apply only to transport between countries who are signatories to the Agreement. In other situations the relevant national provisions of the country in which the vehicle is travelling will apply. There are some 20 signatories to ADR, which includes most central and all Western European countries except for Ireland. It is notable that the national provisions in Ireland closely reflect the ADR requirements. In Eastern Europe there is a move towards alignment with the ADR agreement. Most countries in Eastern Europe are already signatories to the RID Agreement for rail transport and have implemented the UN recommendations.

However many countries are not subject to ADR and in any event ADR, like the UN recommendations, does not address a number of important transport matters, notably emergency preparedness and response, except for the information and expertise provided by the driver and the information provided by the labelling which will assist the emergency services. In addition aspects such as route selection, management systems and matters specific to interfaces with fixed installations and transient storage are not included. There are no specific provisions within ADR for enforcement of the Agreement. This is a matter for the national legislation of individual countries who are signatories to the agreement.

2.3 Directives of the European Community

In response to resolutions in the European Parliament following a number of chemical transport accidents, the Commission of the European Communities (CEC) carried out a survey of national and international transport of dangerous goods within the community. The report of this survey, entitled *Transport of Dangerous Goods -- Final Report* (COM(87)182 Final), was published in 1987. This report made clear the CEC's intention to make proposals to the European Council of Transport Ministers for a number of directives in relation to the transport of dangerous goods.

In order to avoid confusion and duplication, it is important that any such Directives should complement and harmonize with ADR and the UN recommendations as far as possible. This would seem to have been accepted by CEC since one proposed Directive would require EC Member States to accept road vehicles conforming to ADR for international carriage of dangerous goods and wastes and another would require national legislation to harmonize with ADR. Directives on aspects such as training of road transport managers and enforcement of regulations have also been proposed, but to date only a Directive on the training of drivers of road vehicles carrying dangerous goods and wastes has been implemented.

The proposed Directives are likely to play an increasing role in transport matters for EC countries, since once implemented they will be binding on EC Member States. Many countries are of course not part of the EC and so will not be directly affected by the Directives, but they may be indirectly affected by difficulties in standards for international trade if the requirements of the EC Directives do not harmonize with the provisions of ADR and the UN recommendations. However the proposed Directives are not progressing very rapidly and, in any event, would seem to add little to the existing arrangements except perhaps in terms of management training and enforcement.

2.4 National regulations and guidance

Most OECD Member countries in Europe (Western, Central and Eastern Europe) have based their regulations and guidance for international transport on ADR and the UN recommendations. Indeed, in many cases the regulations and guidance for national transport are also based on these internationally agreed guidelines although EC Members will increasingly be required to include EC Directives in their national legislation.

Non-European members of the OECD (notably Australia, Canada and the USA) have in general incorporated the UN recommendations into their regulatory systems for international and national transport, although it is notable that Canada employs a revised substance classification scheme for domestic transport and transport to and from the USA.

In addition to regulations covering international agreements and guidance, the national regulatory regimes of OECD Member countries generally also include aspects of transport such as emergency preparedness, interfaces with fixed installations, truck parking areas, monitoring, and enforcement which are outside the scope of the international recommendations. These aspects may not however always be dealt with within the regulations specific to transport. Thus emergency planning for transport accidents may be considered part of the general planning for civil emergencies and handling of dangerous goods at interfaces may be covered by provisions for fixed installations (e.g. the "Seveso" Directive in EC Countries) or general industrial requirements (e.g. Health and Safety at Work etc Act 1974 in the UK).

The relevant provisions may also depend upon how long the dangerous goods remain at a particular location. For example, in Sweden the transport regulations apply if intermediate storage is short enough to be considered a natural part of the transport; otherwise general industrial safety provisions, enforced by the National Chemicals Inspectorate and National Inspectorate of Explosives and Flammables, apply.

If several modes of transport are involved at an interface (e.g. ports) there may be conflicting provisions and different enforcement arrangements for the different modes. Such situations need to be examined to ensure that the provisions are harmonized as far as is practicable and that the arrangements for enforcement are carefully defined.

Many countries have specific provisions relating to particular concerns or historical practices. For example, in several countries the transport of explosives is controlled more strictly than that of other dangerous goods, a number of countries have provisions for designated routes for dangerous goods transport (e.g. Hungary operates a routing and permit system), France has speed limits for loads above a certain weight, many countries have specific restrictions on dangerous goods traffic through tunnels, and some countries have special training requirements.

Hence for international transport and related aspects of domestic transport there is good agreement within OECD Member countries on the appropriate guidance and regulations required. But in other areas the national legislation of each country reflects national concerns, interests and approaches which may not be shared by other countries.

International trade is essential to all countries, and road transport is an important part of that trade. Achieving greater harmony in national provisions would reduce the differences in the standards and requirements transporters are faced with in travelling between countries. This should assist those responsible for carrying out road transport in recognizing and complying with safety requirements. It should also assist in the monitoring and enforcement of safety standards and in ensuring appropriate national as well as international safety standards. However there may well be specific national requirements for particular aspects of transport which cannot be accommodated within an international agreement. A full examination of alternative approaches is needed to consider which aspects of national provisions could be more closely harmonized, and on what basis, and which aspects must be for specific national judgement. This examination should be as objective as possible if all countries are to be convinced by the conclusions.

3. Accident Prevention

3.1 Introduction

Individuals (e.g. drivers), companies (e.g. consignors, consignees) and public authorities have responsibilities for ensuring the safety of dangerous goods transported by road. The replies to the questionnaire issued to all Member countries by the OECD demonstrate that the roles of these various involved parties are generally similar in all Member countries, although there are some differences in the detailed allocation of responsibilities and the means by which those responsibilities are discharged. In the response from Sweden to the questionnaire, it was suggested that current regulations tend to omit reference to the receiver of the dangerous goods even though he may well be the owner of those goods.

National Authorities are usually responsible for the formulation and enforcement of the primary legislation and regulations which form the framework within which transport by road is carried out. The role of local government depends on the degree of autonomy it enjoys. In a federal country such as Canada, Australia or the USA, the province or state authorities have wider powers to enact their own legislation than local authorities in non-federal countries such as the United Kingdom, although the legislation enacted at state or province level is usually within a framework set by federal legislation to minimize difficulties in transport between states (provinces).

Consignors and other companies involved in loading, unloading and the transport of dangerous goods are responsible for ensuring that the legal requirements are complied with. This should include compliance with the spirit as well as the letter of the law if risks from transport operations are to be minimized. Those responsible for the transport of dangerous goods (i.e. manufacturers, transporters, customers) are responsible for the risks to employees and members of the public from such transport, and therefore they must bear the ultimate responsibility for ensuring those risks are as low as is reasonably practicable. This includes ensuring that effective safety management systems and operational procedures exist covering loading, unloading and parking of vehicles as well as the en-route journey. It also involves factors such as careful selection and training of drivers and other key personnel. Where transport crosses national boundaries, there will be a responsibility to comply with the legal requirements of all the countries through which the transport vehicle passes.

Individuals such as drivers and operators at the loading or unloading points have a responsibility to comply with the instructions and procedures they are given for safe operation.

Further aspects of responsibility which are in need of international attention are the payment of compensation to those who are injured or suffer ill health or property damage as a result of a release of dangerous goods from a transport accident, and the cost of minimizing and repairing environmental damage caused by such a release. The current systems, including insurance schemes, do not seem to be fully effective. One attempt at an international approach, i.e. the Convention on Civil Liability for Damage Caused During the Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels (CRTD), has only been ratified by one OECD Member country.

The above comments are only a brief outline of some aspects of the roles and responsibilities of those involved in the transport of dangerous goods, but even this brief consideration of the matter suggests that there is a need to consider how far legislation should go in defining the roles and responsibilities of those involved in the transport of dangerous goods and in detailing the means by which the various roles and responsibilities should be discharged. Any study of these matters would also need to consider the means by which the legislative system should be enforced.

Compliance with regulations and good systems of management for safety are essential to ensuring safe transport of dangerous substances, but will not guarantee prevention of accidents since every eventuality cannot be foreseen and most transport accidents result from the sort of accidents which arise every day on our roads whether or not vehicles carrying dangerous goods are present, rather than the nature of the cargo. However careful study of accidents and accident trends may identify factors which can be changed to improve the safety of the road transport of dangerous goods. Such analysis requires good data and an effective method of assessment.

An analysis of available data was carried out by the OECD Scientific Experts Group on Transporting Hazardous Goods by Road, whose final study report was published in 1988. This analysis provided a basis for a number of suggestions for aspects of road transport which may assist in the prevention of accidents. However this report also commented that, amongst other difficulties in analyzing the data, the statistics on dangerous material transport were insufficient to allow a complete analysis of risk exposure and they lacked consistency between Member countries as regards the classification of the type of commodity, there were gaps in the coverage of all transport sectors, and data were difficult to collect and process.

Consideration should be given to the development of data bases on traffic flow and accident data with a free flow of information between countries. There may be problems in obtaining resources to start and maintain such data bases, and there may also be problems of a lack of compatibility between hardware and software. However there is no doubt that better data is one of the keys to improved risk assessment and hence to identification of problem areas and appropriate solutions.

3.2 Management for Safety

If effective management for safety is to be achieved in a company, then in addition to a formal compliance with legal requirements management at all levels must accept full responsibility for safety and commit both effort and time to ensuring the highest levels of safety performance are achieved. Safety standards for the various operations of the company and safety objectives which can be measured are required. The safety objectives should be clear to everyone, and progress to achievement should be monitored and assessed.

For the transport of dangerous goods by road, a number of companies may be involved to carry out very different activities. But the above comments apply equally to the manufactures and customers as to the transport companies or shippers who actually move the goods and the operators of any temporary storage point, truck parking area, port, loading or unloading facility, or modal transfer points. The detailed management system, working arrangements and specific safety objectives may vary between the different types of company. Indeed, the detail should be specific to each individual company's needs. But the overall principle and approach should be the same as the overall objective in each case of improving the safety performance.

The Canadian Chemical Producers Association (CCPA) pioneered such a system as part of their "Responsible Care" initiative. This has since been taken up in the United States and several countries in Western Europe, including the United Kingdom. In each case, a "Code of Management Practices" has been or is being developed which is essentially a statement of the safety and environmental standards required by the companies involved. This is an industry-based initiative not directly related to legal requirements. It is of specific relevance to dangerous goods transport since chemical producers are generally manufacturers of the dangerous goods being transported. It is also of general relevance since the general principles and approach of "Responsible Care" would be relevant to all companies involved in transporting dangerous goods.

In essence, "Responsible Care" consists of:

a) safety policies specifying the safety requirements and the responsible persons;
b) safety standards stating what is to be achieved;
c) safety procedures describing in detail how the job should be done to achieve the required standard; and
d) safety guidance explaining as necessary how to convert standards into procedures and policies into standards.

Perhaps the most important contribution management at all levels can make to the safe operation of all aspects of the transport of dangerous substances is to be seen to be totally committed to safety as an integral part of the enterprise.

3.3 Driver training

3.3.1 Introduction

Once the transport vehicle has left its loading point, the driver of the vehicle is generally the only person available to ensure continuing observance of safety procedures during the journey and to anticipate and avoid potential accident events. This key role of the driver was highlighted in the 1988 OECD/RTR Report in which, for accidents caused by dangerous goods vehicles, driver error was identified as the major factor reported by most countries as the cause of accidents. The aspects of driver error identified by the 1988 report include, for example, unsuitable speed, overturning, loss of steering control, failure to give way, errors during reversing, skidding, and errors during overtaking and turning left or right. Alcohol and overtiredness were not reported as being major contributors to the causation of accidents by dangerous goods vehicles. There is however a suggestion that the available data may not fully reflect the extent of these latter aspects

Driver selection, training and testing is therefore a vital element in the prevention of accidents involving the transport of dangerous goods. Companies involved in such transport must ensure they provide adequate selection standards and training procedures for their drivers to minimize the risk of driver error resulting in a major accident. They should also provide working conditions and operating procedures for their drivers which would make the likelihood of accidents as a result of human error as low as is reasonably practicable.

3.3.2 European experience

The importance of driver training and testing is recognized in the ADR Agreement which forms the basis for transport regulation in most European OECD Member countries. This importance is reinforced by the recently finalized EC Directive on driver training, which will come into force from 1 July 1992.

The ADR Agreement requires that drivers of tank wagons or transport units carrying tanks or tank containers possess a certificate of vocational training which is subject to revalidation every five years. The training for this certificate covers:

a) the general requirements governing the transport of dangerous goods;
b) the main types of hazard;
c) preventive and safety measures;
d) what to do after an accident;
e) labelling and marking to indicate danger;
f) what the driver should and should not do during the carriage of dangerous substances;

g) the purpose and method of operation of equipment carried on the transport vehicle; and
h) the handling of the transport vehicle on the road, including movements of the load.

These requirements apply to international transport between countries who are signatories to the ADR Agreement. They are implemented through national instructions for the countries concerned so that the standard of training may not be uniform. In addition, the certificate is only required for transport in tanks exceeding 3000 litres.

As indicated above, many OECD Member countries have based their national legislation on ADR and so similar requirements apply to national as well as international transport. However there is some variation in the detailed provisions. For example, Italy requires a special driving licence international drivers transporting dangerous goods delivered by the *Motorizzazione*, the Netherlands requires a special licence for the transport of explosives, and Norway and the UK include packaged goods in their training requirements. However the latter does not approve training courses, it simply requires the employer to ensure that the driver is adequately trained.

The EC Directive on driver training, mentioned above, largely reflects the provisions of the ADR Agreement. It contains requirements for drivers to attend approved training courses, to take approved examinations, and to be issued with certificates of vocational training. This will apply to drivers of packaged goods vehicles as well as drivers of tank vehicles. The Directive will only apply to EC Member countries, but its implementation will be mandatory within those countries. For the countries concerned, it may reduce the variation in training requirements.

3.3.3 North American experience

In Canada, persons handling, offering for transport or transporting dangerous cargoes must be trained or working under the supervision of a trained person. Training is administered by the employer, who is responsible for the provision of adequate training. The regulations leave it to employers to decide the extent and form of the training within designated subject areas. Industry has argued that this leaves them unclear as to what constitutes adequate training. There is clearly scope here for further guidance from the national authorities as to the general training requirements. However employers should know the specific abilities and therefore the detailed training needs of their employees.

The employer is also responsible for ensuring that training certificates are valid. Training certificates for road transport are valid for three years. The training requirement is enforced by federal dangerous goods inspectors, peace officers and provincial authorities.

In the United States, there are requirements within the provisions of the Hazardous Materials Transportation Act (HMTA) for shippers and carriers of hazardous materials to provide instruction to their employees. However the requirements do not contain any specific training criteria or certification arrangements and so the extent of training is at the discretion of the employer concerned.

3.3.4 Japanese experience

In Japan, persons handling hazardous cargoes require a hazardous materials engineer's licence. The training required is set out in the Fire Service Law and includes the laws relating to hazardous materials handling and fire prevention techniques. The training courses are sponsored by prefectural, urban or local (i.e. city, town or village) governments or other organizations, as specified by the Minister of Home Affairs. The licence may be revoked if a retraining course is not taken within five years.

3.3.5 Conclusions on driver training

Driver training is a key element in the prevention of accidents during the transport of dangerous goods. OECD Member countries have in general recognized this and included requirements for training and certification within national and international regulations and agreements.

However road transport is becoming increasingly international in nature. If the risk of accidents due to driver error is to be minimized then there is a need to develop further guidance on appropriate systems for driver training.

This training should include not only aspects of accident prevention, but also information on the nature of the dangerous goods likely to be carried, the consequences if these goods are released in an accident, and the appropriate emergency response. These latter aspects are necessary since, in the event of an accident, the driver (assuming he survives the accident) will need to take appropriate action until the emergency services arrive. Even after the emergency services arrive, the driver may need to provide information on the goods involved and the most appropriate action to take until more expert sources can be contacted. Training should also include practice where appropriate, for example special driving skills such as control of a "sloshing " liquid or of the action to take in an emergency following an accident.

Responsibility for driver training should rest with the companies employing those involved in the transport activity. These companies should be able to identify training programmes relevant to the specific needs of their employees. However public authorities will need to provide guidance on the essential elements of a training programme and the standard expected for a trained driver. They will also need to provide encouragement to companies to carry out the training and enforcement to ensure standards are being met. Certificates for successfully completing the required training may assist in monitoring and enforcement of training standards. If such certificates were renewable every three years, they would also provide a check that drivers were periodically updating their training. Such training may also be relevant for managers of road haulage companies and others directly involved in transport activities.

3.4 Vehicle design and equipment

The analysis by the OECD Scientific Expert Group of accident data available in the period 1986-1988 was unable to lead to final conclusions on vehicle design factors being a primary cause of accidents involving the transport of dangerous goods. However, it was able to show that vehicle defects and deficiencies are at least a contributory factor. They are also important in determining the nature and extent of any release of dangerous goods, and hence the degree of harm resulting from an accident.

The Group suggested that poor dynamic stability in certain tank and tank-trailer vehicles could be a significant factor in roll-over or loss-of-control accidents, and therefore suggested more stringent stability requirements. In addition, the group suggested improved structural integrity (e.g. reinforcing thin-walled shells and seals on manhole covers) to reduce the likelihood of rupture or leaks from manhole covers following roll-over or rupture following a rear-end or side-on collision.

Similar suggestions for possible improvements in vehicle design to reduce the likelihood of roll-over and vessel puncture are made in a report by an advisory committee to the United Kingdom's Health and Safety Commission (Advisory Committee on Dangerous Substances, *Major hazard aspects of the transport of dangerous substances*, 1991). In addition, this report suggests that studies are needed into, for example, reducing the occurrence of tyre fires, protecting explosives from fires on transport vehicles (e.g. by use of fire screens), and reducing the spread of fire in the cargo compartments of vehicles carrying

explosives. In offering these suggestions, the report makes the point that the cost of implementing design changes should also be considered to ensure it is not in gross disproportion to the benefit to be gained.

In Germany, work is being carried out on technology for safer vehicles, notably a tank truck with a low centre of gravity, special underride barriers and active and passive safety elements at the rear of the truck. In addition, there are safety elements such as electronic tyre pressure monitors, an anti-lock braking system (ABS), skid control and electro-pneumatic gearshift systems. For new vehicles, underride side barriers have been compulsory since 1987. In Austria, ABS has been required on all new dangerous goods vehicles since 1987. From 1993 every vehicle carrying dangerous goods must be fitted with ABS.

An EC Regulation is to be implemented in 1994 which will require heavy goods vehicles in EC Member countries to be equipped with systems to limit their speed. This measure may assist in reducing the number of accidents involving dangerous goods vehicles which result from excessive speeds.

Vehicles carrying dangerous goods are already subject to general regulations covering all road vehicles, as well as certain special provisions covering specialized equipment, tanks etc. Further provisions to increase safety are likely to involve high costs, particularly where large fleets of vehicles are involved. In view of the limited scope for accident prevention, it may be difficult to justify the use of limited resources to pursue vehicle design improvements rather than other more cost effective methods of improving safety. However if the reduction in consequences from an accident is taken into account, some proposals for improvements to vehicle design may be appropriate. Studies are needed to establish both the cost and safety benefits of the various possible improvements to vehicle design in order to avoid pursuing those aspects where the costs are in gross disproportion to the benefits to be gained.

3.5 Permits, licences and pre-notification

Most OECD Member countries have special licensing, permit or pre-notification procedures for certain specific aspects of the transport of dangerous goods. These generally relate to those goods which are, or are at least perceived to be, the most dangerous. However there are significant differences between countries and there would seem to be varying opinions on the usefulness of these provisions.

In essence, these provisions are intended to allow local authorities and emergency services to be aware of (or, ideally, control) movements of certain dangerous goods through the areas for which they are responsible. Hence they can contribute to minimizing the risk of accidents involving the dangerous goods traffic. They can also make preparations to deal with any accidents that do occur. In Germany, for example, a special licence is required for the transport of some extremely dangerous substances (e.g. explosives, liquefied gases and highly toxic acids). This licence normally specifies the route to be used as determined by the road traffic authority. For the transport of dangerous goods in Japan, a routing description must be presented to the relevant fire defence organization before the transport takes place. Pre-notification is also required in the United Kingdom and the Netherlands for the transport of explosives, and in Norway for movements involving "exceptional danger" although there would not seem to be a precise definition of such danger.

As indicated earlier, road transport is increasingly international in nature and harmonization of these various requirements would assist in reducing the likelihood of errors in compliance during movement from one country to another. However the basis for harmonization is not clear, since as yet there would not seem to have been a quantitative assessment of the benefits to be gained from such special provisions over and above the application of the general provisions for the safe transport of dangerous goods. These special

requirements have cost and resource implications for the various enforcing authorities and companies concerned.

Further studies of these matters should be carried out to establish, firstly, which of them provides a significant improvement in safety and, secondly, where appropriate, at what cost. The results of these studies would provide a basis for establishing a policy to harmonize requirements for permits, licences and pre-notifications, for example.

3.6 Designated routes and journey times

3.6.1 Introduction

In principle, the standard of driver training, the quality of management, the safety standards of road vehicles carrying dangerous goods, and the quantity and packaging of such substances should be such that they could travel on all roads at all times without the need to consider other means to reduce risks. However in practice the level of safety achievable by these means will be limited by what is practicable, and so there will always be a residual risk of harm to other road users and to those living, working etc. nearby. This residual risk may be negligible for the transport of small quantities of dangerous goods or goods which are only slightly harmful. But for the transport of large quantities of dangerous goods, particularly those which are highly dangerous, the residual risks may be significant. It is the reduction of this residual risk that the designation (or prohibition) of routes and networks for the movement of dangerous goods seeks to address. In addition, some locations may attract large numbers of people at certain times of the day but not others (e.g. shopping centres are unlikely to be busy late in the evening). Hence, in addition to designated routes, careful scheduling of journey times may offer some benefit in risk reduction.

Several countries have adopted policies for the routing of dangerous goods transport, but there is a marked variation in the nature and extent of those policies and some countries would seem to consider that there is no need for formal regulations on these matters.

3.6.2 European practices

Designated routes for dangerous goods transport to avoid centres of population have been established in many European countries, but national networks have not been set up. Rather the routes are usually defined by local authorities responsible for the centres of population concerned. In some countries designated routes only apply to transport of certain goods judged to be the most dangerous. For example the Netherlands applies routing regulations to a list of "classified substances" (explosives, toxic and highly corrosive substances) which are judged to pose the greatest risks. Germany requires specific written permission from the responsible road transport authority before certain dangerous materials (e.g. ethane, methane and hydrocyanic acid) can be transported by road. If rail or water routes are available, this permission will not be granted.

Many countries employ designated or restricted routing for journeys through tunnels. Thus transport of dangerous goods through major tunnels such as Arlberg, Tauern and Katschberg in Austria can only take place at night and under escort. A designated route for hazardous materials in Belgium is designed to avoid the Kennedy tunnel in Antwerp. In France, prohibitions and restrictions exist for some major tunnels such as the Mont Blanc, the Fréjus and the Fourviers.

Whilst many countries have developed designated routes for dangerous goods, some countries (e.g. Norway and the United Kingdom) have not considered it appropriate. This would seem to be because there is an absence of suitable routes to form a national network and because there has not been a full assessment of the costs, benefits and consequences

of the use of designated routes. In the United Kingdom, the decision on route choice and journey time is for the companies concerned in the transport. In general it is considered that these companies select routes avoiding centres of population where these do not involve an unreasonable detour. However even in the United Kingdom two local authorities (Cleveland and Gwent) have established local voluntary schemes for designated routing, and in Norway restrictions have been introduced on the movement of dangerous substances through certain tunnels.

In countries with designated routing systems compliance is not considered to be high, particularly for international transport. In this latter case, at least, this may in part be due to the variations in routing requirements and systems between countries and also the lack of harmonization in signposting the designated routes.

3.6.3 North American practices

In Canada, municipal and provincial governments have the responsibility for designating dangerous goods routes. Notable routing systems have been established in Alberta, Calgary, Edmonton and Halifax, Nova Scotia, whilst in Montreal routing restrictions apply to the La Fontaine and Ville Marie tunnels. Compliance with the arrangements in Alberta and Montreal is reported to be very high.

In the United States, federal regulations provide general requirements for routing and a designated network has been established for large trucks. The Federal Highway Administration (FHWA) published *Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials* in 1980, and in 1981 the Department of Transportation (DOT) developed a risk assessment model to assist small communities in designating routes. Both models have been used to assist local route selection. In addition, there are a number of bridges, tunnels and ferries which either prohibit or restrict the transport of dangerous goods.

3.6.4 Japanese practices

Advance notice must be given for the transport of gunpowder and pressurized gases. Routing instructions may be issued for such transport. For other dangerous goods, route selection is left to the carriers except that transport of certain listed dangerous goods is prohibited through some underwater tunnels and tunnels more than five kilometres long.

3.6.5 Conclusions on designated routes and journey times

Several countries operate systems of designated routes, but other countries leave decisions on route choice to the transporters. An assessment is needed of the improvement in safety likely to be achieved by a system of designated routing. Consideration would need to be given as to which system would be most practicable for all countries concerned. Consideration will also need to be given to whether the designation of routes will always lead to an improvement in overall safety or always be practicable. After all, vehicles will be travelling much slower in a town centre than on a by-pass, and if dangerous goods traffic is concentrated on a few routes this may lead to an increase in the likelihood of an accident involving that traffic. In some cases, such as the delivery of motor spirit to a town centre or urban garages, routing to avoid concentrations of population may not be practicable. Designated journey times may also not always be practicable or reduce risks in all cases. For example, with long distance, particularly international, transport the overall journey time and the requisite rest periods for the driver may determine the journey time at any particular location, and for releases involving toxic gases atmospheric conditions giving longer hazard ranges are more likely at night.

Tunnels are frequently involved in routing arrangements, but there appears to be little objective assessment to support these arrangements.

In the longer term, land-use development control and directed road building programmes may enable dangerous goods routes avoiding centres of populations to be more readily available. However the cost of these controls will need to be justified by demonstrable improvements in safety.

Detailed study is required of the benefits, costs and consequences of designating routes for dangerous goods transport. Such a study will need to consider not only the potential for risk reduction and the cost to carriers of the designated routes, but also matters such as the national as well as local community implications of any routing decisions and hence the role of national authorities in such decisions; the relative effectiveness of mandatory and voluntary schemes and the means by which a mandatory scheme might be enforced; the appropriateness of providing, for example, safe parking areas and making provision for emergency or land use planning procedures for designated routes; the need to provide routing controls for certain special features such as tunnels irrespective of the overall arrangements for designated routing; the appropriate methodology (e.g. quantified risk assessment, hazard assessment, professional judgement) to be used to decide designated routes or justify routes selected by transport companies.

Such considerations would relate to designation of journey time as well as to the route to be taken.

3.7 Selection of mode of transport

Most countries allow the companies responsible for the transport activities to decide on the transport mode to be used. However provisions in Germany, Austria and Switzerland favour transport by rail or water rather than road. These provisions are largely on the basis that transport by rail or waterway will pose a smaller risk to the environment than transport by road. However in deciding on the relative risks from alternative transport modes it is important to take account of risks to people living in the vicinity of the transport routes, and also other users of the routes as well as risks to the environment.

The 1991 report by an Advisory Committee to the UK's Health and Safety Commission includes a quantified assessment of the relative risks to people in Great Britain from transport by road compared to rail. The results of this assessment demonstrate that a general policy giving preference to one or the other mode on safety grounds would be inappropriate, in Great Britain at least. However the results do suggest that modal choice on safety grounds may be appropriate in specific situations or in countries with road and rail routes very different to those in Britain, since the relative risks from the two modes depend upon the specific characteristics of the routes and goods involved.

Thus for some routes reductions in risk to the environment by the use of rail transport may result in increased risk of harm to people. Conversely a decision in favour of road transport which would reduce the risk of harm to people may result in an increased risk to the environment. Any decision on modal choice should be based on an assessment of risks to both people and the environment. There is a need for criteria for damage to the environment in order to facilitate a comparison with harm to people. Such criteria should be consistent with criteria for environmental effects from accidents at fixed hazardous installations in view of the similarity in substances and consequences involved. As with risks to people demonstrated by the study of transport risks in Britain, the potential for severe environmental damage and hence the degree of risk to the environment is likely to vary with specific route and goods involved. Consequently a policy of modal choice for specific routes and goods rather than a general policy in favour of one mode or another may be appropriate.

A policy in favour of particular modes for specific routes and goods would require risk assessments to be carried out for these specific situations and the results evaluated and enforced. Consideration would need to be given to who should carry out the assessment and make the modal choice. The basis on which any modal choice should be made may also need to include matters such as energy conservation and significant changes to the risk from fixed sites on the transport route (e.g. loading and unloading points, parking areas, marshalling yards, ports). Appropriate arrangements would also be needed for monitoring and enforcement.

In some countries, the variation of risks with route and goods may not be significant. A general policy in favour of any one transport mode may then be appropriate on safety and environmental protection grounds, but further studies would be needed to establish that this was the case.

The use of intermodal transport, notably road/rail transport, is increasing for the movement of dangerous goods. Environmental benefits are considered to be a significant advantage of this type of transport but, as discussed above, even if this is so it is also necessary to take possible increases in risks of harm to people into account. A number of factors suggest that such an increase in risk may be present. These include a difficulty in establishing clear roles and responsibilities when such transport often involves numerous partners and the use of sub-contractors, an increase in transfer activities, and possibly an increase in the use of temporary storage. There is a need for detailed risk assessment of such activities.

3.8 Conclusions on accident prevention

A considerable amount of regulation and guidance is available covering most aspects of the transport of dangerous goods. On aspects of international transport such as classification labelling and packaging of dangerous goods, there is a high degree of harmony. Such measures have helped to ensure that major accidents involving dangerous goods are rare. However accidents involving dangerous goods do occur and the potential for severe consequences is obvious. Consequently there is a need to pursue improvements in the safety of dangerous goods transport. In view of the low likelihood of major accidents actually occurring, it will be necessary to justify the cost of additional safety measures. Hence an appropriate basis would be that measures to improve safety should be introduced provided that the cost of introduction is not in gross disproportion to the expected degree of improvement in safety. Where the benefits of new safety measures are obvious and the costs are clearly low, the new measures should be introduced without question. But in other situations, where the costs are high and the gain in safety is uncertain, a detailed cost benefit analysis will be needed.

Improvements in driver training would be likely to result in a significant reduction in the likelihood of accidents involving dangerous goods, as would improvements in management for safety in companies involved in transporting such goods. In respect of the former, the ADR requirements and the EC Directive on driver training may be appropriate references for the development of appropriate guidance. For the latter, the chemical industry's "Responsible Care" initiative may form a valuable starting point for guidance.

Other measures such as improvements to vehicle design, designation of routes for dangerous goods traffic, and special permits for certain dangerous goods or aspects of transport may produce improvements in safety, but they may also involve considerable costs. Studies will be needed to clarify whether or not such measures should be introduced. The value of these measures in reducing the consequences of any accidents that do occur is an important matter which should be taken into account in any studies. If any aspects of these measures can be identified which would obviously provide improved safety at low cost, then clearly detailed study of that aspect would be unnecessary.

Road transport is increasingly international in nature. Harmonization of a number of the various requirements for accident prevention would assist in reducing the likelihood of errors in compliance during movement from one country to another. However some provisions are for specific national situations. It would not be appropriate to harmonize these. Also, the appropriate basis for harmonization to obtain optimum safety is not clear for many requirements and nor is the means of achieving it. Hence studies are needed to establish which aspects need to be harmonized, what the basis of the harmonization should be, and how harmonization can best be achieved. This last objective would be assisted by the development of relevant guidance.

In pursuing these matters, however, care needs to be taken to avoid duplication of effort with others pursuing the same ends.

4. Mitigation of accident consequences

4.1 Introduction

Accidents will still occur even after all reasonably practicable preventative measures have been taken. Consequently there is a need to consider the value of land-use development controls and emergency preparedness and response in mitigating the consequences of accidents from the transport of dangerous goods. Such mitigating measures are usually planned and executed at a local level within an overall national or federal system. The arrangements at local or national (federal) level are not generally defined within the transport regulations, but are part of wider environmental or civil emergency preparedness arrangements and guidance. However the classification and labelling systems which form part of national and international transport regulations, and the information and expertise which could be provided by an appropriately trained driver of a vehicle carrying dangerous goods (if still able to communicate following an accident), should be of great value in assisting the response of the emergency services. This latter aspect reinforces the value of including in a driver training programme information on the properties and emergency action relevant to the dangerous goods being carried. Relevant information should also be available from data bases and the transport and manufacturing companies involved, but there may be a delay whilst communication is established.

4.2 Land-use development strategies

Land-use development strategies are considered in most OECD Member countries in respect of fixed sites storing or using large quantities of dangerous substances. These sites may well cover many of the loading and unloading points for dangerous goods. However there will be a number of other, smaller sites, where unloading and loading of dangerous goods takes place, which are not covered by such arrangements but where significant off-site risk may exist. In addition fixed points on the transport route such as truck parking areas, ports and interfaces with other modes of transport may also give rise to significant off-site risks but would not be covered by development control arrangements. For ports and harbour areas, consideration of water-use planning would also be relevant.

A fundamental review of the EC "Seveso" Directive, which covers safety provisions for major hazard sites in EC Member countries, is currently underway. Within this review, consideration is being given to including sites such as truck parking areas, railway marshalling yards and ports. However there would still be many sites which are too small to be covered by the Directive but which give rise to off-site risks. Road (or rail) routes would also not be covered. Of course many countries, including many OECD Member countries, would not be covered by this Directive.

Consideration should be given to whether the provisions in the EC Seveso Directive would form a useful basis for guidance, or whether guidance should be developed which includes all sites with a significant off-site risk. Consideration should also be given to the inclusion of major hazard risks from road routes in such guidance. This may be more significant where designated routes for dangerous goods traffic are involved.

4.3 Emergency preparedness and response

4.3.1 Introduction

Effective emergency action in the event of a major transport accident will involve the organization of a prompt and co-ordinated response from fire, police and medical personnel and the assistance of the local authority concerned. It may also involve voluntary or specialist teams from local industry, or from national or regional authorities.

Unlike a major accident at a fixed location, a transport accident can occur anywhere along a road route. It could be in a town or in a rural area, it could be at or close to the boundary between local communities or between countries. It could also occur at any time of the day or night and could involve a wide range of substances with a wide range of different hazards for people and the environment. The potential effect of the hazard will depend on whether people (residents or other road users) or sensitive environmental features (e.g. watercourses, rare species of flora or fauna etc.) are present close to the accident.

These vital factors in deciding on the appropriate emergency response will only be known when an accident happens. Indeed many of them may only be known when the emergency response team arrives at the scene of the accident or appropriate expert advice can be obtained. It is therefore essential that emergency preparedness allows for a flexible response, with good communication between all parties concerned and rapid access to relevant expert advice.

Where the effects of accidents may cross community or country boundaries, it is important that discussions are held to ensure a co-ordinated approach in the event of such an accident. Where different countries are involved, there may be differences in the structure and organization for dealing with emergencies and this may lead to problems in agreeing a common approach to a cross-border accident. For example, one country may deal with a certain scale of accident at a local level whilst its neighbour deals with such an accident at regional or national level. Such differences must be discussed before an accident occurs in order to establish points of contact and arrangements for appropriate information transfer and response. For some accidents, such as spills into rivers, discussions may need to involve several countries.

The precise organizational arrangements, division of responsibilities, planning, practice and availability of information vary significantly between and within countries.

4.3.2 European practices

The widespread influence of the UN recommendations and the ADR agreement has led to a general provision within Europe for driver training, tanker placarding and package labelling. These provisions ensure that some information is available on the dangerous goods and the appropriate emergency action in the event of an accident. In the UK the placard information includes an "emergency action code" to advise the emergency response services of the action they should take to deal with a spill of the goods involved in an accident. This provides a basis for immediate action until further expert advice and information can be obtained. Information may also be made available from special data bases. Thus Denmark maintains a "Product Register" and linked to this is a data base which is accessible 24 hours

a day. In the United Kingdom, most police forces and fire brigades have access to "Chemdata", a national data base of dangerous goods. Other countries, for example Austria and Germany, also maintain such data bases.

In several countries there is a voluntary scheme for the chemical industry to provide assistance on request at the scene of a chemical transport accident (e.g. the "CHEMSAFE" scheme in the United Kingdom). However such schemes may only be really effective for accidents close to the manufacturing site. There is currently a pan-European initiative to provide international co-operation on transport emergency response. This initiative has the project name "ICE".

Emergency planning and response, although usually at a local level, is generally within a national framework. For very large accidents, national organization may be required. For example in France operating plans involving a national operational board, regional co-ordinating boards, plus local fire and emergency response teams have been developed for larger accidents that constitute a serious threat to the population and for which local resources are inadequate.

The responsibility for emergency response is generally with the local fire and police authorities, although the detailed organizational arrangements vary between the OECD Member countries and for large scale accidents responsibility may be with a national civil protection service or national police force. Other services, notably medical services and voluntary organizations (voluntary fire services, industry support teams etc.), are likely to be involved in the event of a serious accident, although the extent of involvement, particularly for voluntary organizations, is likely to vary with the scale of the accident and between countries.

Effective co-operation between those involved in emergency action in order to achieve a co-ordinated response in the event of an accident requires an awareness of the role to be played by each of the various bodies concerned, and a carefully prepared flexible emergency plan which has been practised to ensure it operates smoothly and efficiently. Most countries in Europe have developed plans to deal with major civil emergencies and accidents involving large quantities of dangerous goods at fixed sites; indeed the EC "Seveso" Directive requires the latter provision within EC Member States. However since the responsibility for detailed planning rests with local authorities, the emergency plans and arrangements for dealing with accidents involving the transport of dangerous goods would seem to be generally somewhat variable. This may partly be a reflection of the differing levels of knowledge, expertise and awareness of the risks from accidents involving such goods. For example, those locations close to fixed major chemical hazard sites may be more aware and have a greater level of information on the risks than locations remote from such sites.

4.3.3 North American practices

In Canada, the Transport of Dangerous Goods Directorate maintains a comprehensive data base of dangerous substances being handled. It also has access to a wide range of emergency equipment and a good communications system. The Coast Guard emergency service is also well equipped and has a well organized communications system, but its knowledge and expertise regarding dangerous substances are not as comprehensive as those of the Transport of Dangerous Goods Directorate.

National regulations require the manufacturer, shipper, importer and, in some cases, the carrier of dangerous substances to file a summary of their emergency response capabilities with the Transport of Dangerous Goods Directorate. Among other things, this summary must contain a brief description and certification of the emergency response capability and the means by which it can be activated. These summaries are checked and approved (or not, as the case may be) by the Transport of Dangerous Goods Directorate.

Municipalities, major ports and airports have contingency plans which can be activated by anyone calling the local emergency response organizations (fire, police etc.) or the 24-hour emergency response number contained in dangerous goods documentation.

The Transport of Dangerous Goods Directorate provides general information and advice to persons responding to emergency situations via a "Dangerous Goods Guide to Initial Emergency Response" which it distributes to emergency response organizations. More detailed and product-specific information can be obtained from a 24-hour emergency response centre (CANUTEC) operated by the Federal Department of Transport.

In the United States, the Environmental Protection Agency (EPA) provides assistance with guidance and technical assistance, but the responsibility for emergency response arrangements for transport accidents rests with local communities. The local capabilities may be supplemented by State provision. For example, in Illinois equipment is available from ten highway maintenance depots to assist local response agencies in handling major releases of hazardous material. Federal assistance from EPA and the Coast Guard is available for responding to significant incidents.

As the emergency response is a local community matter, there may be difficulties in obtaining rapid identification of a released material or adequate information on remedial action. The requirement for knowledge of the regulations on hazardous materials to be part of a driver's qualifications may help to some extent in this matter. Further help is provided by a 24-hour, free telephone advice service provided by the Chemical Manufacturers Association. This service, CHEMTREC, provides immediate advice on handling the first stages of a chemical release and a contact with the manufacturers for further follow-up. CHEMTREC also provides training aids and handbooks for developing community response programmes. National, state and local reporting is required by, for example, the Department of Transport and EPA for accidents involving a release of hazardous substances at fixed installations or during transport. Such reporting is carried out through a National Response Centre which operates a 24-hour facility.

4.4 Conclusions on mitigation of accident consequences

4.4.1 Land-use development strategies

Land-use development strategies can play a part in mitigating the consequences of an accident involving dangerous goods by virtue of preventing, or at least minimizing, incompatible land uses, i.e. avoiding the co-location of dangerous goods routes or sites with concentrations of citizens or sensitive environmental areas. This will have a cost in restricting the use that can be made of certain areas of land. It will also not protect other road users.

Off-site risks are generally taken into account for sites handling large quantities of dangerous goods. For EC Member States, the proposed revision of the "Seveso" Directive seeks to include, for example, truck parking areas, railway marshalling yards and ports, but only those handling large quantities of dangerous goods. Studies would seem to be needed to consider whether land-use development strategies should also include risks from dangerous goods at smaller sites, smaller fixed points on the transport routes, and the transport routes themselves. This last mentioned aspect may also need to be considered in respect of the effect of designation of certain routes for dangerous goods transport.

4.4.2 Emergency preparedness and response

The value of emergency preparedness and response in mitigating the consequences of accidents involving dangerous goods is generally recognized by OECD Member countries, but the extent and nature of the provision varies significantly both within and between Member countries. There is therefore a need to consider what provision is appropriate for emergency preparedness and response, and to what extent the arrangements can be harmonized both within and between countries.

Emergency preparedness and appropriate response can play an important role in mitigating the consequences of an accident during the transport of dangerous goods. To do so, there needs to be flexible forward planning by all responsible authorities, emergency services and, where practical, manufacturers, transporters and customers to ensure that an appropriate response is made whatever the nature of the accident.

Such emergency preparedness should include an effective but simple plan for emergency response, which could be readily understood and carried out by all those involved in dealing with the wide range of accidents that might occur. The plan will need to include provision for rapid hazard identification and the establishment of the likely effects of the hazard on people and the environment. This information will enable decisions to be taken on matters such as what should be done with those people in the vicinity of the accident, including the need for evacuation, and the extent of, or need for, any exclusion zone around the accident site. It will also be necessary to ensure that effective communications are rapidly established and maintained between all those involved in the emergency response. Provision should also be made for liaison with the media, to ensure that appropriate and accurate information is disseminated. Inaccurate information will only cause further distress to the public. The media may also be useful in passing on information to the citizens on the action they should take. One vital aspect of emergency preparedness is to practice the emergency response plan and arrangements. This brings all the participants together so that each can understand the others' strengths and weaknesses. It also allows flaws in the plan to be identified. Such practice may be of the "table top" variety, i.e. a case study on paper, or it may take the form of physical simulation of an accident. The latter will enable manpower, equipment, access routes etc. to be tested.

Such emergency preparedness should be provided for all areas subject to dangerous goods transport, to ensure effective emergency response to any accidents that may occur. The response arrangements should be as harmonized as possible, to minimize difficulties in delivering a co-ordinated response to accidents with transboundary effects. This latter may be difficult where systems for dealing with emergencies are very different in neighbouring countries, or where there are more general national considerations. However special local arrangements may then need to be discussed.

Emergency preparedness and response will not prevent accidents occurring, but an effective response can substantially reduce the consequences when an accident does occur. Effective response will only result if the correct preparation has taken place.

5. Conclusions

Provisions to control the transport of dangerous goods have been formulated to reduce the risks from such transport and to facilitate national and international trade. However accidents involving dangerous goods still occur, albeit infrequently. Consequently there is a need to consider further measures to improve safety, with appropriate measures being introduced provided the cost of such measures is not in gross disproportion to the benefit to be gained in improved safety.

On a similar basis, whilst in general arrangements for emergency preparedness and response have been made in OECD Member countries, consideration should still be given to possible means of improvement.

Where legislative provisions and guidance are drawn from international recommendations and agreements, there is good agreement between countries. But in several other areas, including emergency preparedness and response, marked differences exist. In view of the growing international nature of road transport, there is a need to consider whether further harmonization could be achieved. This may assist in reducing the likelihood of transporters making errors in trying to comply with changing requirements during movement between countries. It may also facilitate better cross-border co-operation in responding to emergencies. Clearly where there is agreement, or where agreement is being pursued by other bodies, there is no need to establish projects to develop detailed guidance, but in other areas such effort would be of value.

Thus guidance on matters such as driver training, management for safety, emergency preparedness and response, and land-use development strategies would seem to be appropriate. It would also be appropriate to address research activity to resolving the marked differences of approach between countries to designated routing (including matters such as transport through tunnels and modal choice), vehicle design, permits, risks at interfaces with fixed locations (which could include loading and unloading, parking areas etc.), and the value of land-use development strategies at smaller fixed sites and along transport routes. In addition there is a need for improved availability of information on details of traffic flows and accidents involving the transport of dangerous goods.

Guidance on the classification, labelling and packaging of dangerous goods has been developed by the UN. This guidance has received general acceptance, and harmonization is being pursued with other international guidance, such as that contained in the ADR agreement which operates between many European countries. Improvements in this guidance, such as changes to the system of classification, would be best pursued through the UN Committee. Any separate system would further complicate moves towards harmonization. However there is a need to consider the value, role and applicability of electronic labelling and marking systems to assist in monitoring vehicle loads and in providing emergency services with information and advance warning of hazards and remedial measures.

Transport by road generally accounts for a large tonnage of movement of dangerous goods. These goods have the potential for widespread harmful effects, but they are also highly important to the economy of all countries. The correct balance needs to be struck so that safety standards are high enough to ensure that the risks of harm to citizens and those working for the companies involved in the transport activities are as low as is reasonably practicable.

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