



NATIONAL POLLUTANT INVENTORY



Technical Advisory Panel

Final report to

**National Environment
Protection Council**

January 1999

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Executive Summary

Introduction

The Technical Advisory Panel to the National Pollutant Inventory was formed in March 1997 to recommend substances for inclusion on the National Pollutant Inventory. The terms of reference for the Panel are given in Appendix I.

The Panel met nine times during March and April 1997 and produced a report which was released together with the draft NEPM at the commencement of the consultation period in June 1997. The Panel continued to meet over the next few months, to fine tune various aspects of their work, and to revisit aspects of the report in the light of submissions and other comments made during the public and key stakeholder consultation.

Since the publication of the report in June 1997 until the NEPM was made on 27 February 1998, the Panel continued to provide advice and assistance to the Project Team, the Jurisdictional Reference Network and the National Environment Protection Council (NEPC) Committee.

The assigning of component scores to substances, the combining of these scores to generate total risk scores, and the use of the risk scores to rank substances so that decisions could be made on a reporting list, were processes developed specifically for the purpose of constructing a National Pollutant Inventory, and the Panel cautions against their use in other contexts.

The National Pollutant Inventory, as finally agreed by the National Environment Protection Council, requires reporting on 36 substances in the first and second reporting years. This number may increase to 90 in the third reporting year, subject to a review of the Inventory in late 1999.

Risk Scores and Ranking of Substances

The Panel drew up a comprehensive list of approximately 400 substances. Excluded from the list were substances banned in Australia or scheduled for phase-out, and those substances for which other reporting was in place because of their ozone depleting or greenhouse effects. Although the scoring system could be used for agricultural and veterinary chemicals, as well as industrial chemicals, the treatment was not felt to be ideal and so agvets were also excluded. They may be handled by alternative prioritisation schemes, and the review of the NPI may offer an opportunity to do this. These substances are discussed in Chapter 6.

A robust system of scoring and ranking substances, sufficiently sensitive to reflect particular contributions to total risk but not so sensitive as to place undue weight on any one factor, is described below. Other possible ways of achieving this are also described. An outline is given here, and full details in Chapters 1-3, in fulfilment of the Panel's commitment to transparency in its work.

Each substance on the list was evaluated on 0-3 scales for human health effects, environment effects, and exposure. The health and environment

effects were summed to give a 0-6 hazard score, and this was multiplied by the exposure score so as to give a total risk score on a 0-18 scale which facilitated ranking of the substances.

$$\text{Risk} = \text{Hazard (Human Health + Environment)} \times \text{Exposure}$$

Recommendations were made on the way this ranking could be used to generate the reporting list.

Each of the three contributions to the risk score was itself constructed by assigning scores (0-3) to a range of attributes, and these components were combined as follows:

- Human health effects - evaluating acute toxicity, chronic toxicity, carcinogenicity, and reproductive toxicity of a given substance to arrive at a score on its effect on human health.

$$\text{Human Health} = \frac{\text{acute toxicity} + \text{chronic toxicity}}{2}$$

Chronic human health toxicity is calculated as a function of:

$$\frac{\text{chronic} + \text{reproductive toxicity} + \text{carcinogenicity}}{3}$$

- Environment effects - evaluating acute toxicity, chronic toxicity, persistence, and bioaccumulation of a given substance to arrive at a score on its effect on the environment.

$$\text{Environment} = \frac{\text{acute toxicity} + \text{chronic toxicity}}{2}$$

The chronic environment component may be derived as a single score (see Section 2.3.3) or it may need to be arrived at by combination of the three factors described above, and normalisation to the 0-3 scale, before it is used in determining the single environment score.

$$\text{chronic} = \frac{\text{default chronic toxicity} + \text{persistence} + \text{bioaccumulation}}{3}$$

As a further alternative for nitrates and phosphates in solution (total nitrogen and phosphorus), the environment score may be replaced by a 'second order effect' score which, in the judgment of the Panel, reflects the unwanted nutrient effects of such pollutants.

- Exposure - evaluating the potential release in Australia through a combination of point and diffuse sources, bioavailability, environmental fate and volume of production.

$$\text{Exposure} = \frac{(\text{point sources} + \text{diffuse emissions})}{6} \times \text{bioavailability}$$

with the diffuse release score being constructed as follows:

$$\text{diffuse} = \frac{\text{production volume} \times \text{environmental fate}}{6}$$

The panel recommends to the National Environment Protection Council that the substances listed at Appendix II comprise the initial reporting list for the National Pollutant Inventory. Appendix III presents these substances in priority order. The full list, with details of scores assigned, is given in Appendix IV.

Thresholds

The Panel has drawn heavily on the overseas experience in recommending that the thresholds for most reporting should be based on amounts of substances handled, rather than amounts of substance released or number of employees. Quantity handled thus serves as a guide to amount likely to be released, although in the special cases of the nutrients (nitrogen and phosphorus which give rise to nitrate and phosphate respectively) the threshold is the actual quantity released. For a small group of substances which are the products of combustion or thermal processes, the recommended thresholds are based on fuel or waste burned, or power consumed.

Some recommended exemptions are also set out in Chapter 4.

Particular Substances

In Chapter 5, twelve examples are discussed in detail, either because of difficulties encountered by the Panel or because changes were made to scoring after the Panel had considered submissions made to it.

Although the particulate matter considered by the Panel was that of size less than 10 μm (PM_{10}), a brief discussion is offered of the case for reducing this size limit to 2.5 μm ($\text{PM}_{2.5}$). The Panel recommends that the larger limit be retained until the matter is reviewed on the basis of improved data compilations becoming available.

A number of members of the group of substances known as Volatile Organic Compounds (VOCs) are recommended for inclusion in the NPI, but the group itself is not. The cases for and against its inclusion are set out in this chapter.

Agricultural and Veterinary Chemicals

Unlike the substances on the reporting list, the usage of agvet chemicals involves their deliberate release into the environment, although this may be indirect, as in the case of veterinary chemicals for ingestion or injection. Most members of the Panel felt that the scoring system developed for the NPI could be applied to agvet chemicals, but recognised the above difficulties and others which would arise if this were done. For instance, 'non-active' constituents, including solvents, administered along with the active substances. The decision as to whether to include agvets in the reporting list was not one that

was referred to the Panel, and so Chapter 6 contains information that will be of use to the NEPC Committee, rather than firm recommendations.

Recommendations

The Panel recommends that the Committee:

1. accept the risk based criteria and the ranking system developed by the Panel, detailed in Chapters 1-3;
2. accept the list of substances, provided at Appendix II, as the reporting list for the National Pollutant Inventory;
3. note the inherent limitations of any system which attempts to characterise risk in a simple uni-dimensional 'score';
4. release this report of the Technical Advisory Panel, with its Appendices, as an adjunct to the NEPM.

Chapter 1

Criteria for Substance Selection

1.1 The General Approach

The Technical Advisory Panel broadly supported the earlier approach taken by Pacific Air and Noise (PAAN) (1996) to score and rank nominated substances. That earlier work began with a list of approximately 180 substances developed by the Queensland Department of Environment as a starting point. The substances on this list were prioritised by PAAN on the basis of numerical scores (0-3) expressing relative hazards and expected environmental impacts. While the resulting priority listing was broadly consistent with expectations of stakeholders, the simplistic nature of the methodology was questioned, in particular the lack of regard paid to human health considerations. Certain specific matters also remained unresolved, including the speciation of metals, the inclusion of chemicals that had industrial as well as agricultural uses, and the treatment of non-methane volatile organic compounds (VOCs).

The methodology adopted by the Technical Advisory Panel was of the same type as that used by PAAN, but the starting point was a much longer list of substances, and scores were assigned to a broader range of attributes for each substance. In the first instance, substances from the Worksafe 1996 draft list of hazardous substances were added to those on the PAAN list, giving a master list of approximately 400 substances. This list included agricultural and veterinary (agvet) chemicals, which were removed from consideration at a later stage, since a decision had been taken not to include agvets in the NPI.

For each substance, the Panel combined, in ways discussed below, the scores for human health and environment to generate a hazard score, and this was multiplied by the combined exposure score to generate an overall risk score according to the traditional view that:

$$\text{hazard} \times \text{exposure} = \text{risk}$$

These component scores, together with the consolidated human health, environment, hazard, exposure and overall risk scores are displayed with the comprehensive list of substances which appears at Appendix III.

1.2 Component Scores for Substances

The Panel agreed to retain the 0-3 scoring of effects because the criteria for assigning scores lacked greater precision than could be expressed by this small range of possible scores. The risks posed by particular substances to health and environment are extremely complex phenomena, difficult to characterise with any real accuracy in a simple uni-dimensional measure, and because of this the scores must be regarded as being orders of magnitude, or at best as being only semi-quantitative. Semi-quantitative data were necessary, however, for the manipulation of scores and subsequent making of comparisons between substances. The prioritisation process simply involves the combining of semi-quantitative scores. Chapter 2 details the methods by which individual score components were derived and Chapter 3 shows the method of combining component scores to achieve overall scores which would be useful in ranking substances.

The scoring of individual human health and environment attributes of substances was based on the risk phrases established by the European Commission (EC). These risk phrases have been developed by the EC as summary statements for a range of hazards, and a substance is assigned a risk phrase after being assessed against detailed criteria. Where EC Risk Phrases were not available for the substances under consideration, recourse was had to experimental data on human health, either directly or as summarised by bodies such as USEPA or PAAN (and used in the earlier work on NPI ranking). The approach is described in more detail in Chapter 2, and details of these risk phrases and the assessing criteria are provided at [Appendix IV](#). In the assignment of a particular score (0, 1, 2, or 3) to an attribute of a substance, the score is to be assigned if the substance is described by one or more of the criterion descriptors provided for a particular score. The descriptor assigned should be the highest one for which the substance meets one or more criteria.

The Panel has exercised a precautionary approach in scoring the attributes of substances. Whereas proven negligible or nil effects attract a score of zero, a rating of '1' (or low) is used when, in the Panel's opinion, there is no evidence or insufficient evidence of negligible effect.

1.3 Combining component scores

The TAP considered a number of methods by which the scores for different attributes of the substances could be combined so as to permit the generation of a prioritised list upon which the NPI reporting list could be based. The simplest method considered was to recommend for listing any substance which received a maximum score (that is, 3) for any attribute. This 'cut-off' approach was rejected because it would not permit ranking of substances in priority order. Such an approach could be developed, also, to apply a series of cut-offs sequentially, so that a substance which was above the cut-off in, say, human health effect, would receive further consideration and be carried through the process only if it surmounted successive cut-off hurdles. A more sophisticated version of this approach would use a matrix in which scores for two attributes are displayed, and substances scoring above pre-determined levels in both attributes are entered onto the list. For instance, environment

and human health scores may be juxtaposed, or scores based on certain combinations of attributes - hazard and exposure, for example - may form the basis of the matrix methodology. Such approaches avoid uncertainties about whether equivalent scores for different attributes should be accorded the same or different weights (whether a 3 for environmental effect means the same thing as a 3 for human health effect, for instance).

None of these 'cut-off' approaches, however, permit substance-by-substance ranking for all of the substances on the master list. The method the Panel used to combine component scores in such a way as to achieve this aim, and some discussion of alternatives, including some suggested during the public consultation process are discussed in Chapter 3.

1.4 Transparency and robustness

The Panel took the view that as broad a range of hazard and exposure attributes as possible should be incorporated into the scoring system and that simple methods of combining component scores should be adopted. Simple combinations of component scores - which are not a feature of the prioritisation processes involved in toxic release inventories drawn up in other countries - make it easy for interested parties to work through the process for themselves. They thus contribute greatly to the transparency of the process. Robustness is achieved when the overall score is sensitive to individual component scores, but is not markedly dependent upon any single component score, being thus protected against the inadvertent use of inappropriate data or defaults used when relevant data are unavailable. Such robustness is generated by the compromise between use of a small data set, with its associated transparency and apparent incisiveness, and a large data set for which it might be difficult to provide adequate data and which, in any case, swamps the influence that significant data should have on the overall score. For example, in terms of exposure, the Panel has expanded the original 'release' attribute to now include: point and diffuse emissions, quantities involved, ultimate fate in the environment, and speciation. In some cases there is a paucity of relevant data, and the TAP has relied on the application of cautious professional judgement, as set out later in this report.

Chapter 2

Scoring of Substances

2.1. The List of Substances Considered

As mentioned in Chapter 1, the Panel considered a wide range of substances and developed a comprehensive list with approximately 400 entries. The major sources for this were the priority list of approximately 150 substances, developed through the Queensland Department of Environment and Heritage trial and further refined by PAAN, the Worksafe Australia List of Designated Hazardous Substances, and the List of Substances classified by the European Union as Hazardous to the Environment. The Panel agreed to include all substances for which EC Environment Risk Phrases R50 to R59 (Appendix VI) were recorded.

The Panel agreed to exclude those substances that were banned in Australia or scheduled for phase-out. The Panel was aware, however, that the withdrawal of any such substance could be delayed or that stocks could continue to be held despite its withdrawal from use. For this reason the Panel has left some of these substances in the list so that their relative ranking is clear. Some substances recently withdrawn or still being phased out have thus been italicised in Appendix IV;

The Panel also agreed to exclude ozone depleting and greenhouse gas substances (unless included for other reason, for example toxicity) on the basis that sufficient action was already underway to deal with these substances. Following the consultation period, a number of other 'substances' were excluded, including animal and vegetable fats and oils (which were felt to be sufficiently managed by existing licence requirements), and distillates such as coal tar and solvent naphtha, for which representative components (benzene, PAHs, phenols) were already on the comprehensive list. Suggestions that Biological Oxygen Demand (BOD) might be added to the list received the Panel's careful consideration, especially in connection with the inclusion of second order effects as an alternative component in the environment category. It was felt, however, that BOD was a distant surrogate for substances already included on the list, and was also influenced by other factors, and so its inclusion on the list was not supported.

For the purposes of the scoring exercise, the Panel considered those agricultural and veterinary substances scoring EC Risk Phrases R50 to R59 or those which were on the National Registration Authority's Priority Existing Chemicals list. There were approximately 20 of these. The issue of including agvets in the comprehensive list is discussed in Chapter 5.

Some attention was paid to classes of compounds, such as the alkoxyethanols and fluorine compounds (including hydrogen fluoride), and to speciation of metals. By 'speciation' is meant the separate categorisation of, for instance, chromium (III) and chromium (VI) and nickel subsulfide in contrast to other nickel substances. In particular cases, reporting facilities may choose to avail themselves of opportunities for speciation, for instance reporting Cr(III) and

Cr(VI) separately. Where such speciation is not reported, then the default value will be the higher of the two; small operations may choose to report in this way rather than incur the expense of speciating their releases.

One issue which limited the effectiveness of scoring all substances on the comprehensive list was the lack of information on the human or environment effects of some of the substances. In addition many of these substances on the comprehensive list are not used, or not used to any great extent in Australia's comparatively shallow industrial base, so their exposure scores are low. Nonetheless, as mentioned above, a precautionary approach was adopted so that a 0 score was only allocated in cases where there was evidence of nil or negligible effect, the default for insufficient information being a score of 1.

The end result was a comprehensive list of approximately 400 substances.

2.2 Human Health Scores

The hazard rating scheme assigns scores of 3,2,1, and zero to each of four human health attributes - acute toxicity, chronic toxicity, carcinogenicity, and reproductive toxicity. For ease of interpretation of the information which follows, scores of 3, 2, 1 and 0 are accompanied by verbal descriptors - high (very toxic), medium (toxic), low (harmful) and zero.

The scores for human health effects are based on the EC Risk Phrases (as defined in the European Commission Directive reproduced in [Appendix VI](#)), and on other toxicity data as indicated, with the original PAAN scores used only where other information is lacking.

For an explanation of the terms used in assigning the score, see [Appendix V](#) - Acronyms and Abbreviations and Glossary of Terms.

2.2.1 Acute Toxicity

The following EC Risk Phases were applied in arriving at a score for acute toxicity effects on human health. As risk phrases for human health effects are well developed the default score from PAAN was not often applied.

High '3' (Very Toxic) - was assigned if the substance was described by one of the EC Risk Phrases R26 to R28 and R35:

R26 - Very toxic by inhalation;
R27 - Very toxic in contact with skin;
R28 - Very Toxic if swallowed; or
R35 - Causes severe burns.

Default - as scored by PAAN.

Medium '2' (Toxic) - EC Risk Phrases R23 to R25 and R34:

R23 - Toxic by inhalation;
R24 - Toxic in contact with skin;
R25 - Toxic if swallowed; or
R34 - Causes burns.

Default - as scored by PAAN.

Low '1' (Harmful) - EC Risk Phrases R20 to R22, R36 to R38 and R65:

R20 - Harmful by inhalation;
R21 - Harmful in contact with skin;
R22 - Harmful if swallowed
R36 - Irritating to eyes;
R37 - Irritating to respiratory system;
R38 - Irritating to skin; or
R65 - Harmful if taken in lungs.

Default - as scored by PAAN.

Zero - evidence indicating negligible Acute Toxicity; no EC Risk Phrases and no evidence or $LD_{50} \geq 5000$.

2.2.2 Chronic Toxicity

Just as for acute toxicity, chronic toxicity scores are arrived at by applying EC risk phrases, with the PAAN scores retained as defaults.

High '3' (Very Toxic):

R39 - Danger of very serious irreversible effects; and

- Default
- Adequate evidence in humans and/or two animal species of chronic health effects;
 - Sufficient human or animal evidence of developmental toxicity;
 - Adequate evidence in humans and/or two animal species of neurotoxicity.;
 - USEPA categories 1 to 5 on heritable mutations; or
 - MED ≤ 10.

Medium '2' (Toxic):

R33 - Danger of cumulative effect;

R42 - May cause sensitisation by inhalation; or

R43 - May cause sensitisation by skin contact.

- Default
- suggestive evidence in humans and/or two animal species of chronic health effects;
 - Insufficient evidence, but with some data indicating possible developmental effects;
 - Suggestive evidence of neurotoxicity effects;
 - USEPA category 6; or
 - 10 < MED ≤ 100.

Low '1' (Harmful):

- Limited evidence or no evidence proving negligible effect;
- USEPA categories 7 and 8; or
- MED > 100.

Zero

- Sufficient human or animal evidence indicating a lack of developmental toxicity; or
- Adequate evidence for negligible chronic effects.

2.2.3 Carcinogenicity

Scoring for carcinogenicity is based on consideration of EC Risk Phrases using the categories developed by the International Agency for Research on Cancer (IARC) as a default. In applying risk phrases, sub-categories have been used to provide adequate sensitivity for scoring.

High '3' - EC Risk phrases R45 (category 1) and R49 (category 1):

- R45 (category 1) - may cause cancer - there is sufficient evidence to establish a causal association between human exposure and the development of cancer;
- R46 (category 1) - may cause heritable genetic damage (no entries recorded); or
- R49 - as for R45(c1) but also - may cause cancer by inhalation.
- Default - IARC categories 1 and 2a (part with epidemiological evidence).

Medium '2' - EC Risk phrases R45 (category 2), R49 (category 2) and R46:

- R45 (category 2) - may cause cancer - should be regarded as if they cause cancer;
- R49 (category 2) - as for R45 (c2) but also - may cause cancer by inhalation; or
- R46 (category 2) - may cause heritable genetic damage.
- Default - IARC category 2b (part no epidemiological evidence).

Low '1' - EC Risk Phrases R40 (category 3):

- R40 (category 3 or M3) - Possible risk of irreversible effects - specifically substances which cause concern for humans owing to possible cancer or mutagen causing effects but in respect of which available information is not adequate for a making a satisfactory comment.
- Default - IARC category 3.

Zero - Adequate evidence indicating negligible effects from appropriate animal tests;
- No EC Risk Phrases; or
- IARC category 4.

2.2.4 Reproductive Toxicity

Reproductive toxicity is a collector for a range of toxicological effects including teratogenicity, embryotoxicity and foetotoxicity, effects on fertility, effects on lactation, and endocrine effects such as oestrogen and androgen disruption effects. Specifically EC Risk phrases for the following scores, and the PAAN defaults, have been used.

High '3' -

R60 (category 1) - known to impair fertility; or
R61 (category 1) - known to cause harm to the unborn child.
Default - Positive evidence.

Note also that no substance entered into the list has scored a 3.

Medium '2' -

R60 (category 2) - May impair fertility; or
R61 (category 2) - May cause harm to the unborn child.
Default - Known or probable positive evidence.

Low '1' - EC Risk Phrases R63 and R62:

R64 - May cause harm to breast feeding babies;
R63 - Possible risk of harm to the unborn child; or
R62 - Possible risk of impaired fertility.
Default - Possible positive evidence.

Zero - Known, probable or possible negative evidence.

2.2.5 Single human health score

Following the assignment of these four component scores for human health attributes of a substance, the Health score was arrived at by first combining the chronic component scores and then dividing them by 3:

$$\frac{\text{chronic} + \text{reproductive toxicity} + \text{carcinogenicity}}{3}$$

This 'chronic' score, which combines the components commonly associated with chronic effects is then combined with the acute component score and divided by 2, thus normalising the score to the 0-3 scale.

$$\text{Human Health} = \frac{\text{acute} + \text{chronic}}{2}$$

It is important to note that the initial scoring system proposed by the Panel summed all of the component scores and then divided them by 4, thus normalising again to the 0-3 scale. However on review the Panel adopted the system outlined above, as it mirrored that of the Environment score (see below) and better reflected common practice.

2.3 Environment Scores

The environment hazard rating scheme assigns scores of 3, 2, 1, and zero to each of four environment attributes - acute toxicity, chronic toxicity, persistence, and bioaccumulation. Again the numerical scores 3, 2, and 1 are accompanied by verbal descriptors high, medium and low.

'Persistence' and 'bioavailability' are not criteria that can be applied to all chemicals. An organic substance such as ethanol would persist for a time in the environment but eventually be degraded, whereas a metal such as copper would persist indefinitely. Bioaccumulation is a characteristic of certain fat-soluble and chemically stable substances. Certain metal species may also bioaccumulate and in some cases - those of essential trace elements, for instance - this may be beneficial rather than harmful.

The scores for acute and chronic toxicity were based on the EC Risk Phrases, while those for persistence and bioaccumulation were based on diverse experimental data applied as criteria in the ways listed below. However, the EC Risk Phrases for chronic toxicity already incorporate a measure of persistence and bioaccumulation, so when a risk phrase was used to score chronic toxicity, the persistence and bioaccumulation scores were discarded. Where EC Risk Phrases were not applicable, the original scoring of the three components applied by PAAN was retained.

A matter which was discussed during the initial work of the Panel, but remained unresolved at the time that the draft NEPM was released, was what came to be known as 'second order effects'. The approach adopted so far to the scoring of environmental effects is essentially toxicological, and does not produce high scores for substances which, although not toxic to any serious degree, nonetheless pose environmental problems. For instance, soluble phosphates or nitrates, or substances which give rise to them in the environment, can cause unwanted biological proliferation and even eutrophication of lakes and streams. Further examples might involve nitrogen oxides (which appear on the reporting list because of their intrinsic toxicity) and volatile organic compounds (VOCs), which interact to produce ozone in the lower atmosphere.

A resolution of this dilemma was found through the introduction of an alternative method of generating an environment score, which could replace the four-component approach and lead to a single score based on Panel

judgment of the severity of the second order effect. When applied to nitrate and phosphate (in solutions), this alternative approach produced very high total risk scores. The details are set out in Chapter 5, together with a discussion of the case of VOCs.

2.3.1 Acute Toxicity

Acute toxicity was measured by the appropriate risk phrase (see below) based on toxicity to aquatic organisms. In general, aquatic organisms are more sensitive to chemical effects than are terrestrial organisms, and it is thus appropriate to use such criteria in the general case. If no information was available from the risk phrases then the default criteria were used.

High '3' (Very Toxic) - EC Risk Phrase R50: Very toxic to aquatic organisms.

- Default
- Aquatic LC₅₀ < 100ppb;
 - Mammalian⁵⁰ or avian LD₅₀ < 5mg/kg; or
 - Avian 5-day dietary LC₅₀ < 20ppm.

Medium '2' (Toxic) - EC Risk Phrase R51, R54 and R55

- R51: Toxic to aquatic organisms;
R54: Toxic to flora; or
R55: Toxic to fauna.

- Default:
- 100 ppb < aquatic LC₅₀ < 10 ppm;
 - 5 mg/kg < mammalian⁵⁰ or avian LD₅₀ < 500 mg/kg;
 - or
 - 20ppm < avian 5 day dietary LC₅₀ < 200 ppm.

Low '1' (Harmful) - EC Risk Phrase R52: Harmful to aquatic organisms.

- Default
- Aquatic LC₅₀ > 10ppm;
 - Mammalian⁵⁰ or avian LD₅₀ > 500 mg/kg; or
 - Avian 5-day dietary LC₅₀ > 200ppm.

Zero - evidence is available indicating negligible effect.

2.3.2 Combined chronic toxicity, persistence, and bioaccumulation

A range of tests was used to generate a single score for chronic toxicity, persistence, and bioaccumulation. In the first instance, the chronic toxicity criteria applied by the EC in risk phrases R53 and R58 incorporate some degree of chronic toxicity, persistence and bioaccumulation, so application of the risk phrase is equivalent to generating a combined score.

Thus chronic toxicity is attributed as follows:

High '3' (Very Toxic) - EC Risk Phrases R53 and R58:

R53: May cause long term adverse effects in the aquatic environment; or

R58: May cause long term adverse effects in the environment.

If no appropriate risk phrase was assigned, then separate scores for the three components were evaluated as described below.

2.3.3 Chronic toxicity

High '3' (Very Toxic)

- Aquatic MATC < 10ppb;
- Mammalian or avian MATC < 2ppm; or
- Plant EC₅₀ < 100ppb.

Medium '2' (Toxic)

- 10ppb < aquatic MATC < 100ppb;
- 2ppm < mammalian or avian MATC < 200ppm; or
- 100ppb < plant EC₅₀ < 1ppm.

Low '1' (Harmful)

- Aquatic MATC > 100ppb;
- Mammalian or avian MATC > 200ppm;
- Plant EC₅₀ > 1ppm.

Zero - evidence is available indicating negligible effect.

2.3.4 Persistence

Persistence may also be considered separately from chronic toxicity, in which case the score is based on a measure of how long the substance remains in the environment. Note that EC Risk Phrases are not applicable, as the EC considers persistence in the context of other attributes. The scoring system below was originally applied by PAAN, using a wide range of criteria:

High '3' - Aquatic $LC_{50} < 1\text{ppm}$ plus continuous or repeated (C/R) releases or one-time release with chemical half-life < 14 days;

- Aquatic MATC $< 100\text{ppb}$ plus C/R releases or one-time release with chemical half-life < 4 days;
- Mammalian or avian $LD_{50} < 1\text{mg/kg}$ plus C/R releases or one-time release with chemical half-life < 14 days;
- Mammalian or avian MATC $< 20\text{ppm}$ or plant $EC_{50} < 1\text{ppm}$, plus C/R or one-time release with chemical half-life < 4 days⁵⁰; or
- Avian 5 day dietary $LC_{50} < 200\text{ppm}$ plus C/R or one-time release with chemical half-life < 14 days.

Medium '2' - $1\text{ppm} < \text{aquatic } LC_{50} < 10\text{ppm}$ plus C/R or one-time release with chemical half-life < 14 days;

- $100\text{ppb} < \text{aquatic MATC} < 1\text{ppm}$ plus C/R or one-time release with chemical half-life < 4 days;
- $50 \text{ mg/kg} < \text{mammalian or avian } LD_{50} < 500 \text{ mg/kg}$ plus C/R or one-time release with chemical half-life < 14 days;
- $20\text{ppm} < \text{mammalian or avian MATC} < 200\text{ppm}$ or $1\text{ppm} < \text{plant } EC_{50} < 10\text{ppm}$, plus C/R releases or one-time release with chemical half-life < 4 days; or
- $200\text{ppm} < \text{avian 5 day dietary } LC_{50} < 2,000\text{ppm}$ plus C/R releases or one time release with chemical half-life < 14 days.

Low '1' - Aquatic $LC_{50} > 10\text{ppm}$ plus continuous or repeated C/R or one-time release with chemical half-life < 14 days;

- Aquatic MATC $> 1\text{ppm}$ plus C/R or one-time release with chemical half-life < 4 days;
- Mammalian or avian $LD_{50} > 500 \text{ mg/kg}$ plus C/R releases of one-time release with chemical half-life < 14 days;
- Mammalian or avian MATC $> 200\text{ppm}$ or plant $EC_{50} > 10\text{ppm}$, plus C/R or one-time release with chemical half-life < 4 days⁵⁰; or
- Avian 5-day dietary $LC_{50} > 2,000 \text{ ppm}$ plus C/R or one-time release with chemical half-life < 14 days.

Zero - evidence is available indicating negligible persistence in the environment.

2.3.5 Bioaccumulation

EC Risk Phrases are not applicable to bioaccumulation scoring as the EC considers bioaccumulation in the context of other attributes. The scoring system below was originally applied by PAAN, using a wide range of measurable attributes for bioaccumulation:

High '3' - Aquatic $LC_{50} < 10\text{ppm}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;

- Aquatic MATC $< 100\text{ppb}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;
- Mammalian or avian $LD_{50} < 200 \text{ mg/kg}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;
- Mammalian or avian MATC $< 20\text{ppm}$ or plant $EC_{50} < 10\text{ppm}$, plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$; or
- Avian 5 day dietary $LC_{50} < 500 \text{ ppm}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$.

Medium '2' - $10\text{ppm} < \text{aquatic } LC_{50} < 100\text{ppm}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$ or

- $100\text{ppb} < \text{aquatic MATC} < 1\text{ppm}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$ or
- $200 \text{ mg/kg} < \text{mammalian or avian } LC_{50} < 2,000 \text{ mg/kg}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$ or
- $200\text{ppm} < \text{mammalian or avian MATC} < 200\text{ppm}$ or $10\text{ppm} < \text{plant } EC_{50} < 100\text{ppm}$, plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$; or
- $500\text{ppm} < \text{avian 5-day dietary } LC_{50} < 5,000\text{ppm}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$.

Low '1' - Aquatic $LC_{50} > 100\text{ppm}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;

- Aquatic MATC $> 1 \text{ ppm}$ plus $BCF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;
- Mammalian or avian $LC_{50} > 2,000 \text{ mg/kg}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$;
- Mammalian or avian MATC $> 200\text{ppm}$ or plant $EC_{50} > 100\text{ppm}$, plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$; or
- Avian 5-day dietary $LC_{50} > 5,000\text{ppm}$ plus BCF or $BAF < 1,000$ or measured $\log P < 4.35$ or estimated $\log P < 5.5$.

Zero - evidence is available indicating negligible bioaccumulation.

2.3.6 Single environment score

The environment score may, alternatively, be an expression of the 'second-order effects' and therefore consist of a single component score, but only the soluble nitrates and phosphates have been assessed in this way. More generally, the environment score is formed by addition of the acute and chronic environmental components, normalising to the 0-3 scale by halving their sum.

$$\text{Environment} = \frac{\text{acute} + \text{chronic}}{2}$$

The chronic environment component may be derived as a single score (see Section 2.3.3) or it may need to be arrived at by combination of the three factors described above, and normalisation to the 0-3 scale, before it is used in determining the single environment score.

$$\text{chronic} = \frac{\text{default chronic toxicity} + \text{persistence} + \text{bioaccumulation}}{3}$$

2.4. Exposure Scores

The component scores generated for use in deriving exposure scores are the least precise of the data sets employed in the scoring process. Relatively little information is available about production volumes for many substances. Manufacturers and users are reluctant to release such data because, they say, in a comparatively small market, such information is commercially sensitive. Assistance was obtained from the Plastics and Chemicals Industries Association in making the estimates used here, but the panel is aware that better data could become available in the future and may lead to revision of some scores. The data should only be considered in the context of this report and not as general indicators of importation, production or use.

There is nothing circular about using estimates of releases to the environment in the scoring system which will eventually guide the reporting of such releases. The Panel notes, however, that if accurate data were available then one major reason for implementing the National Pollutant Inventory would be obviated! The exposure score acts to a large extent as a modifier of the effect of the hazard data, most of which are firmly based (and this is especially true for the substances of greatest concern), to the extent that a very low exposure score almost certainly will result in a substance not appearing on the reporting list, no matter how intrinsically hazardous it might be. This is seen as practical outcome of the approach taken here, which sees a risk score as the product of hazard and exposure scores.

In order to arrive at exposure scores the Panel has refined the previous work undertaken by PAAN, by generating scores for point source and diffuse emissions together with a bioavailability scoring.

Chemicals on the comprehensive list of substances have exposure scores derived from the following formula, in which the exposure score is normalised to the 0-3 scale:

$$\text{Exposure} = \frac{(A + B) E}{6}, \quad \text{where } B = \frac{C \times D}{3}$$

and the components A - E are defined as follows:

A = point source release score where:

- 3 = high release and widespread release or use
- 2 = release or use in moderate amounts
- 1 = low release or use
- 0 = no release to environment or no use in Australia

B = diffuse source release score (0-3), based on the same hierarchy of releases

C = quantity involved where:

- 3 = high level production, generation, importation or use
- 2 = medium level production, generation, importation or use
- 1 = minimal level production, generation, importation or use
- 0 = no production, generation, importation or use

D = ultimate fate in the environment where:

- 3 = all product ends up in the environment
- 2 = significant environmental releases
- 1 = minor release or use as product
- 0 = all transformed or destroyed in manufacture

E = bioavailability in the environment where

- 3 = widely bioavailable forms present in the environment (little influence of environmental factors in reducing toxicity).
- 2 = bioavailable forms in the environment under certain circumstances (for example acid soils, low redox, specific host sensitivity)
- 1 = rarely in bioavailable forms in the environment (most environmental factors ameliorate any toxicity)
- 0 = no bioavailable form (chemical or physical) known in the environment;

The bioavailability component, E, is scored according to the above scheme whether a single species or group of species is being evaluated. This criterion was developed to differentiate substances, in particular metals, which though widely released to the environment are not widely bioavailable. The bioavailability criterion for most substances is given as 3 as, in the opinion of the Panel, this represented an appropriately precautionary approach to this issue. Only where there was evidence of reduced bioavailability did the Panel allocate a lower score. The Panel encourages the refinement of the scores allocated as further information becomes available.

2.5 A Worked Example

The example below shows how this methodology is applied in the case of formaldehyde which is ranked at #55 with a risk score of 3.6:

For human health:

- acute toxicity formaldehyde is considered by the EC to be toxic if inhaled (EC R23), swallowed (EC R25) or in contact with skin (EC R24) and also causes burns (EC R34). These descriptors equal a score of '2'.
- chronic toxicity there are no EC risk phrase descriptors for formaldehyde but examination of the descriptors indicates that formaldehyde meets one of the descriptors for a score of '3'. So formaldehyde scores a '3' for chronic toxicity in human health;
- carcinogenicity formaldehyde is considered by the EC to have possible risk of irreversible cancer or mutagen causing effects. This descriptor equals a score of '1'; and
- reproductive toxicity formaldehyde receives a score of zero as it does not trigger either the EC risk phrase descriptors or the default descriptors.

The resultant human health score is 1.5

For environment;

- acute toxicity (note this is a different measure to human health acute toxicity); formaldehyde is considered by the EC to be very toxic to aquatic organisms (EC R50). This descriptor scores a '2';
- chronic toxicity there are no EC risk phrase descriptors for formaldehyde but examination of the descriptors indicates that formaldehyde meets one of them for a score of '1'; and
- in addition as there is no EC risk phrase the descriptors of bioaccumulation and persistence are triggers but these score '0'

The resultant environment score is 1.2

For exposure;

- formaldehyde is a widely used and produced substance and so scores a '2' both in the point source and production volume categories;
- formaldehyde though does not disperse widely into the environment and only scores a '1'; and
- as it is an individual organic substance it is assumed to be widely bioavailable and scores a '3'.

The resultant exposure score is 1.3. The resultant risk score is $(1.5 + 1.2) * 1.3 = 3.6$.

Chapter 3

Evaluation of Total Risk Scores and Construction of the National Pollutant Inventory

3.1 Risk = Hazard x Exposure

Although a number of schemes were explored, the Panel recognised quite early that prioritisation based on relative risk, with risk representing a combination of intrinsic hazard (to human health or the environment) with the likelihood of exposure, was a sound basis for drawing up the National Pollutant Inventory. This is not to deny the validity and usefulness of 'cut-off' approaches, touched on in Chapter 1 and further developed later in this section. The Panel recognised in the risk approach, however, a combination of simplicity with coverage of the issues of concern, and devoted most of its effort to this approach.

While the relative risk approach is commonly discussed, there seemed to be no compelling logic which led to a method for combining the risk scores. Should the approach be an additive one, or was it more appropriate to multiply the separate components together? And, in whatever approach were chosen, would it be appropriate to simply combine the human health and environment scores, or should the final result be based on the greater of the two, in a protocol which would combine elements of the cut-off approach with the overall combinatorial one?

Making use of spread-sheet capability, several approaches of this kind were explored. The outcome was that, by the time prioritisation had extended to about the first hundred substances, most approaches led to the same suite of substances appearing in the proposed reporting list. The exact order in which substances appeared on the draft list depended upon the scheme used to combine the component scores. Similar substances were thrown up by the cut-off approach, in which substances with a score of 3 in any of the categories, human health, environment or exposure, were proposed for listing, but following this approach it was not possible to generate a prioritised list.

After extensive discussion of these points, the Panel eventually opted for summation of the single scores for human health and environment, so as to give a hazard score in the range 0-6, and multiplication of this sum by the exposure score (0-3), leading to risk scores in the range 0-18. In order not to give an impression of precision which would belie the semi-quantitative nature of the scoring and combining process, all risk scores were rounded to one decimal place before being used to rank the substances to give a proposed reporting list. The full table of component scores and scores derived from them, including the final risk scores, is shown in Appendix III, in which the substances are arranged in order of relative risk. Only one - oxides of nitrogen - had a risk score above 10, but there were 22 in the range 6-10, and 57 in the range 3-5.

On the master list, there are 89 substances with risk scores of 3 or above (the addition of VOCs to table two makes the list total 90), and the Panel considers that a reporting list comprising these substances would be appropriate for a National Pollutant Inventory. There is no technical reason that the Panel could discern for breaking the list at any particular point, and so the advice of the Panel is here based on what practitioners believe would be practical for reporting facilities whilst including on the list almost all substances about which there have been major concerns in recent years. The fact that so many of this group of substances appear high on the recommended reporting list is evidence of the appropriateness of the ranking scheme adopted by the Panel. One member of the panel referred to such scrutiny of the list as constituting a 'reality check', which we take to mean a cross check on the didactic methodology through comparison with the integrated judgment of Panel members, based on their experience. That this 'reality check' is subjective, is evidenced by the fact that two submissions (discussed in the next section) embodied other scientists' reality checks and contained suggestions for alternative scoring systems which would produce results more in accord with their perceptions.

The Panel was also moved to advise to the Project Team that substances with the same integer risk score should be regarded as posing equivalent degrees of risk and thus the list should only be broken between integer scores. The Project Team may choose, for instance, to recommend a reporting list comprising substances with risk scores of 5 or above, or (as the Panel recommends) of 3 or above, but is advised not make a break in the middle of the '3' range or '4' range. In like fashion, it would be appropriate to use the breaks between integer risk scores as places where the reporting list might be subdivided. If the list were to be implemented in stages, the Project Team might wish to begin implementation with a list comprising substances with risk scores of greater than 5 or 4, and expand it to incorporate those down to 3, at a later date.

3.2 Alternative Approaches

An approach which simply places substances with one or more component scores above a pre-determined level onto the reporting list has been touched on in earlier sections of this report, and rejected by the Panel as inadequate for the task of prioritising substances through their risk scores. Such approaches are in widespread use, however, and one of interest is that developed by Imperial Chemical Industries (ICI) and used world-wide. The approach is styled the Environmental Burden (EB) with which to 'assess the potential harm to people and environment from chemical emissions'. For each substance under consideration, factors (based as far as possible on experimental data) are assigned, representing the impact of that substance on seven targets, including human health, acidification, global warming and photochemical ozone formation. The mass of substance released is then multiplied by the impact factor and the EB on each target is arrived at by summing the burdens arising from different substances. Such an approach, using estimated emissions, could be adapted to construction of a reporting list, but the ICI approach was not further pursued by the Panel.

Two submissions took up the matter of score generation and combination in some detail. Neither was preferred by the Panel to the approach eventually adopted (and described in Section 3.1), but the substance of the alternative approaches is presented here together with reflections on them which arose from Panel discussion:

Several submissions were received from one participant in the public consultation process. The first began with the contentions that (i) too much weighting had been accorded to acute toxicity data, (ii) it was important to distinguish between the environmental compartments which received various emissions, (iii) the exposure scores were too high, as a consequence of neglecting rapid destruction of released substances and (iv) the inclusion of PAAN scores detracted from the transparency of the process. Whilst conceding the last point, the Panel affirmed their satisfaction with much of the PAAN data and drew attention to the consistency between PAAN-derived scores and others. The submission argued that the 0-3 scale was essentially logarithmic, and might even have been extended as far as 5, so as to give a 100,000-fold range of scores. For human health, it was suggested that the score be derived by dividing the quantity emitted by some simple number, such as the adult LD₅₀, to arrive at a measure of the number of toxic doses emitted. Such numbers could then be used to prioritise the list of substances.

In the second submission, the participant expressed support for a cut-off approach because of its simplicity, but suggested the use of four categories - acute and chronic effects on both human health and the environment should be treated separately. The resulting list was not capable of fine prioritisation, but the Panel noted that the list so generated closely resembled that generated by the Panel's own trials of such approaches.

The third submission brought together two of these elements in the following way. Firstly, it was argued that the component scores were in fact logarithmic and that combination of them should therefore be limited to addition - equivalent to multiplication of the raw numbers from which the logarithms

were presumed to have been derived. Secondly, the four categories of the previous paragraph were retained, and scores were arrived at by adding the existing component scores (after some minor revisions) to newly derived exposure scores. A cut-off could then be applied. The Panel considered this option but noted that when it was applied to substances in each of the four groups, the result was a proposed reporting list much like that described for the simpler process but without the benefit of a ranking (used, for example to phase in the list).

Another submission adopted a similar position on the component scores, likening the 0-3 to numbers a logarithmic scale for which addition, but not multiplication, would be an appropriate operation. The submission suggested the adoption of a 0, 1, 3, 10 scale so as to encompass the great differences between substances to which different risk phrases applied, and the removal of the exposure factor from the determination of the final risk score. The submission also recommended tighter connection between toxicological data and the component scores - for instance acute health scores based on very toxic (<20), toxic (20-200) and harmful (200-2000 mg/kg), and acute environment based on aquatic toxicities of <1, 1-10 and 10-100 mg/l. This approach was said to give less prominence to substances such as ethyl acetate, which owes its presence on the Panel's list as much to volume of production and release as it does to intrinsic human health or environmental effects. The Panel, however, preferred to include expressions of exposure and the classical depiction of risk as comprising elements of both hazard and exposure, and also noted that the submission's approach was less effective at ranking substances.

It is of interest to compare the ranking recommended by the Panel with that which would result from several of the alternatives considered above, and this is done in the following table.

In column 1, are the Panel's ten highest-ranked substances. Column two shows how the top ten would appear if total hazard and risk scores were summed, and column three the order obtained when human health, environment and exposure component scores are multiplied together. The fourth column shows the result of using the system suggested in the third submission described above. All of this information is contained on page 1 of Appendix III, but is arranged here for greater clarity. Numbers in brackets, accompanying some entries in columns 2-4, show the rank order of these substances as they appear in Appendix III, for substances ranked lower than tenth.

The ten highest ranked substances, in order, from several score-combining protocols

	PANEL	SCORES SUMMED	PRODUCT OF SCORES	SUBMISSION
1	Oxides of Nitrogen	Oxides of nitrogen	Oxides of Nitrogen	Oxides of Nitrogen
2	Chromium (VI) compounds	Chromium (VI) compounds	Chromium (VI) compounds	Chromium (VI) compounds
3	Carbon monoxide	Cadmium and compounds	Cadmium and compounds	Carbon monoxide
4	Sulphur dioxide	Sulphur dioxide	Arsenic and compounds	Dichloromethane
5	Dichloromethane	Carbon monoxide	Sulphuric acid	Sulphur dioxide
6	Cadmium and	Arsenic and	Sulphur dioxide	Xylenes

	compounds	compounds		
7	Particulate matter 10 μm	Sulphuric acid	Dichloromethane	Particulate matter
8	Sulphuric acid	Dichloromethane	Glutaraldehyde (14)	Glutaraldehyde (14)
9	Xylenes	Particulate matter	Lead and compounds (11)	Acetone (22)
10	Arsenic and compounds	Total nitrogen (17)	Trichloroethylene (12)	Methyl ethyl ketone (21)

The consistency with which substances appear in the top ten is reassuring, in the sense that the prioritisation is only weakly dependent on the chosen method for combining scores. The differences between outcomes of the different methods are more significant further down the list, as can be seen from data in Appendix III.

3.3 Synergistic Effects

One submission raised possibility that synergies might exist between pairs or groups of substances and pointed out that such effects would not be recognised by the scoring system adopted by the Panel. Although toxicologists are showing increased interest in synergistic effects, very few examples have been identified. Given the difficulty of doing so, the Panel did not attempt to incorporate synergy in the scoring system. If this were to be attempted, the Panel observed, there would be difficulties encountered even with the well-known example of asbestos and tobacco smoke, since neither component consists of a single substance, although asbestos fibres would probably fit comfortably into the particles (PM₁₀) category. Other examples which had been reported involved organochlorine pesticides, which were not at this stage to be included in the reporting list.

Nonetheless, the Panel recommended that this matter be brought before a technical group for review, at an appropriate stage.

Chapter 4

Thresholds for the National Pollutant Inventory

4.1 The Design Principles

The thresholds which should trigger reporting to the National Pollutant Inventory are based on principles of simplicity and fairness. Under the first principle, thresholds are in most instances based on the amounts of substances handled, rather than on the amounts released or on surrogates such as the number of employees at a facility. Where the emitted substance is a by-product or impurity, the quantity is made to refer to the fuel or waste which ultimately gives rise to the substance of concern. The exceptions relate to nitrates and phosphates, for which the thresholds are the amounts released, and to those facilities for which electrical power consumption is the best measure of the scale of the activity.

The thresholds are thus easy to understand and will allow emitters to participate confidently and accurately in the National Pollutant Inventory. Substances on the Inventory are identified as belonging to the categories to which different thresholds apply.

A facility includes all buildings, equipment, structures, or other stationary items that are located at a single site or at contiguous or adjacent sites and that are owned or operated by the same company or individual. It should be noted that thresholds have been set high enough to exempt small business from any reporting burden. In addition, some specific activities have been exempted from reporting, and these exemptions are discussed in Section 4.4.2.

Beyond determining whether a facility needs to report, the thresholds proposed by the Panel do not provide guidance on other aspects of reporting to the National Pollutant Inventory. The question of inclusion of transfers in the Inventory, and the development of techniques to assist facilities in determining which listed chemicals they are likely to emit and the best ways of measuring or estimating these releases, were not included in the Terms of Reference for the Technical Advisory Panel

4.2 Categories of Substances

Each substance was assigned to at least one of three categories, for which appropriate thresholds were recommended.

- Category 1 contains a broad range of hazardous substances. They display a diversity of effects and arise from a diversity of sources, being typically present in materials used for production purposes. In a sense, this is a default category to which substances are assigned if they do not meet criteria for inclusion in any sub-section of the second category.
- Category 2 contains a group of pollutants which are generally common products of combustion or other thermal processes. Category 2 has been sub-divided on a load basis.

Category 2a contains the more common or voluminous products of combustion - oxides of nitrogen, carbon monoxide, particulate matter, and sulphur dioxide - from a wide range of combustion sources. The fluorides include hydrogen fluoride, which may be emitted by aluminium smelters. Polycyclic aromatic hydrocarbons (PAH) may arise from a number of combustion and thermal processes.

Category 2b contains a range of trace metals, for which emissions are significant when large quantities of fuel, especially coal and oil, are consumed, together with polychlorinated dioxins and furans.

- Category 3 contains 'total nitrogen' and 'total phosphorus' which are surrogates for the nutrients nitrate and phosphate in solution. The thresholds are quantities emitted. This approach has been used because, for significant sources of nutrients released to waterways, such loads are already used for licensing or are likely to be introduced by jurisdictions in the near future. The thresholds for Category 3 will capture medium to large waste-water treatment plants (including sewage treatment facilities), medium to large intensive livestock facilities, and larger facilities involved in food and beverage manufacture and processing, together with the actual manufacturers of such substances.

In general, any person who owns or operates a facility must report to the Inventory if a threshold is exceeded in a reporting period, which is expected to be one year.

4.3 Thresholds

Threshold quantities were determined on the basis of experience with reporting trials. The intention is to elicit reports from major emitting facilities without putting undue burdens on the operation of small facilities.

Category 1 Any facility which handles, manufactures, imports, processes, or otherwise uses 10 tonne or more of any of the substances listed in Appendix 2 as belonging to Category 1, will report its emissions of such substances. Most substances in the table fall into this category.

Category 2 These substances are by-products or impurities not deliberately handled or produced. In general, they are products of incomplete combustion or products associated with the use of fuel or electrical energy.

Category 2a A facility will report its emissions of Category 2a substances if the mass of fuel or waste burned amounts to or exceeds 400 tonne or if a peak hourly rate of 1.0 tonne is achieved. The substances in this category are:

Fluoride compounds (including hydrogen fluoride)
Oxides of nitrogen
Particulate matter 10.0 µm

Polycyclic aromatic hydrocarbons
Sulphur dioxide
Hydrogen chloride (hydrochloric acid)
Carbon monoxide

Category 2b A facility will report its emissions of Category 2b substances if the mass of fuel or waste burned amounts to or exceeds 2 000 tonne per year or if 60,000 megawatt hour or more of energy is consumed, or if power is consumed at the rate of 20 megawatt or more. The substances in this category are:

Arsenic & compounds
Beryllium & compounds
Cadmium & compounds
Chromium (III) compounds
Chromium (VI) compounds
Copper & compounds
Lead & compounds
Magnesium oxide fume
Mercury & compounds
Nickel & compounds
Nickel carbonyl
Nickel subsulfide
Polychlorinated dioxins and furans

Category 3 A facility will report its releases of Category 3 substances if its emissions to water of the nutrients listed equals or exceeds the following quantities:

Nitrogen	15 tonnes
Phosphorus	3 tonnes

In each case, reporting should be on the basis of the total amount of nitrogen or phosphorus emitted.

4.4 Exemptions

While the categories and thresholds given in the preceding two sections are of broad applicability, there remain some instances where clarification is necessary. In the main, these involve 'common sense' elaboration of the basic specifications. There should be provision for exemption for small facilities which, although handling listed substances in quantities beyond the thresholds, are nonetheless not technically equipped to report and would be put to great hardship if required to do so.

4.4.1 Article Exemption

Some facilities might qualify for article exemption because a listed substance forms part of a commercial product and, although quantities in excess of the threshold may be involved, the substance is never 'handled' in the sense intended by the specifications above. Such facilities might include hardware stores and supermarkets retailing products such as paints and domestic pesticides, household aerosols, and laboratory chemicals containing NPI listed substances and retailers of motor vehicles containing listed metals. Additionally, the article exemption should be applied to facilities engaged in manufacturing, wholesaling, or distribution if the equipment and machinery used contains listed substances. This article use exemption applies to only Category 1 threshold and emission determinations, and not to Category 2 or 3 thresholds which are derived from levels of combustion and emission loads respectively.

An article is defined as a manufactured item that is formed to a specific shape or design during manufacture, that has end-use functions dependent in whole or in part on its shape or design during end-use, and that does not release a listed substance under normal conditions of the handling, processing, or otherwise use of that item at the facility. The article exemption applies to the normal handling, processing, or otherwise use of an article. The exemption should not apply to the manufacturing process of the article itself. Listed substances processed into articles produced at a facility must be taken into account when threshold and release determinations are made.

4.4.2 Activity Exemption

The spirit of designing thresholds for the NPI requires that small businesses should not be caught in any reporting obligation. While this consideration was adhered to by the Panel in designing the threshold system, there could nevertheless be examples of small business sectors which might yet exceed the recommended reporting thresholds. These include:

- petrol stations engaging in the distribution, storage, or retail sale of fuels;
- retail drycleaning establishments;
- scrap-metal handlers trading in metal and not undertaking remelting, reprocessing of batteries or thermal processes; and
- agricultural production (ie farms). Often farms could exceed the use thresholds of the primarily industrial substances present on the NPI reporting list. Note this exemption should not relate to agricultural processing (ie tanneries).

The Panel notes that during consultation a few additional types of small facilities were added to this list.

4.5 Mixtures and Trade Name Products

NPI listed substances contained in mixtures and trade name products will need to be factored into threshold determinations. A facility which processes or otherwise uses such products is required to use the best information available to determine whether the reportable components of the product are used in amounts which trigger any of the reporting thresholds. This may prove difficult if concentration information is not provided by the supplier, but the facility should make every endeavour to obtain it.

Chapter 5

Discussion of Particular Substances

The approach adopted by the Panel in developing the scoring system was to examine many substances (over 400), rank them, and then scrutinise those substances near the top of the list (because of the high risks attributed to them). However, certain substances received even greater scrutiny, and panel discussion concerning them is reflected in this chapter. The consultation period brought helpful submissions, and in a number of cases discussions were continued with their authors. Some scores were revised when new data were located, and substances in some groups were given more individual attention; for example, the Panel's taking a speciation approach to the listing of some of the metals.

5.1 Reporting Metals and Metal Compounds

Metals and metal containing compounds are handled differently to the individual substances present on the NPI reporting list. When considering the Category 1 threshold of a metal and compounds entry facilities are required to examine the total amount of the metal and its various compounds handled. If this is exceeded facilities are then required to report their emissions of the metal and the metal component of the compounds only. In addition, it is recommended that facilities triggering a Category 1 threshold should have the option of reporting either the total metal released from their facility or the quantity released from each individual metal compound (or species) emitted.

For example, if a facility processes several different copper compounds, the threshold determination is based on the total weight of all copper and copper compounds handled. However only the emissions of the copper metal are reportable (including that metal emitted in a compound), with the weight other components of the compounds excluded from emission determinations. However, the facility, once triggering the threshold, may choose to report either the total aggregate copper released from all compounds combined or choose to report the amount of copper released by listing the weight of elemental copper for each individual copper compound released by the facility.

Some metal compounds may contain more than one listed metal, for example, lead chromate, which is both a lead and a chromium (VI) compound. Assuming that the facility handles no other lead or chromium (VI) substances, the threshold would be triggered when the quantity of lead chromate passes 10 tonne, but two separate release reports are required, one for lead and one for chromium VI.

5.2 Speciation of Metals

The Panel's initial approach was to list metals and their compounds in generic entries as 'substances' (see 5.1), but it soon became clear that this approach was inadequate for dealing with metals which might be in different oxidation states, in soluble and insoluble forms, or combined in ways that give rise to

specific toxicity. For some metals - lead, cadmium, zinc and mercury, for instance - there was little to be gained by speciation, but in the case of nickel the subsulfide and the carbonyl derivative were far more toxic than other nickel species and so were listed separately.

Chromium compounds may contain the metal in hexavalent form - chromium (VI), as in the chromates used as pigments and in chromic acid and similar substances used in electroplating - or in the trivalent form - chromium (III), as used in leather tanning. Thus the two types were listed separately, with chromium (III) receiving the lower risk score. One submission provided data which enabled the panel to reassess the scoring of chromium (III), leading to its lower ranking.

Metal speciation is a complex matter, and reporting practice is expected to evolve so as to provide more meaningful results than simply metal totals.

5.3 Aluminium(fume and dust), Alumina

Aluminium was considered by the Panel in two ways; as aluminium (fume and dust) and as alumina (or aluminium oxide).

Highly dispersed dry forms of aluminium and aluminium compounds were originally considered for listing on the NPI. 'Dust' refers to solid particles generated by any mechanical processing of aluminium including crushing, grinding, handling, and decrepitation of aluminium ores, and metal. 'Fume' refers to an airborne dispersion consisting of smaller solid particles created by condensation from a gaseous state, as distinct from the gas or vapour itself, and normally arises from the heating of aluminium metal.

However, during consultation, the Panel were presented with evidence that aluminium fume and dust do not constitute a greater hazard than that scored in connection with its being particulate matter. Particles have received a high risk score and are further discussed below.

Aluminium oxide was also considered by the Panel as one candidate substance amongst over 400 substances. However, on further investigation the Panel concluded that only a specific form of aluminium oxide, the fibrous form, was at issue. The Panel also discovered that aluminium oxide (fibrous form) related only to aircraft manufacturing, an industry not generally present in Australia, and concluded that the substance was not widely emitted in Australia. The resulting low exposure score allocated by the Panel meant that aluminium oxide (fibrous form) was not considered any further. Many of the 400 plus substances considered by the Panel fell into a similar category, that is of sufficiently low exposure not to warrant further consideration.

5.4 Particulate Matter

That small particles impact on human health is widely accepted, and it is known that particles consist of organic or inorganic matter, and sometimes combinations of both with organics adsorbed onto inorganic material. The predominant standard has consisted in measurement of the mass of particles of size 10 µm or smaller - designated PM₁₀ - but there is increasing emphasis

on smaller particles - PM_{2.5} or even PM_{1.0} - as those presenting the greatest hazard. Several submissions raised the question of reporting the smaller particles.

Most jurisdictions have in place PM₁₀ monitoring programs, and there exist data upon which trend analyses can be based, and so the Panel opted for PM₁₀ as the 'substance' to be considered for the NPI. In doing so, however, the Panel recommended that jurisdictions should envisage a move to the reporting of smaller particles - either PM_{2.5} or PM_{1.0} - and prepare themselves for it. Specific attention should be directed to this point in any review of the reporting list.

There will exist a problem for facilities in determining when the threshold for particulate matter has been reached, since few applications would call for 10 tonne of particles of 10 µm or less. More likely, such particles will be among the emissions from mining and quarrying operations, from coal and ore stockpiles, and from operations such as sand blasting. There will also be, in many locations, considerable non-anthropogenic background concentrations. The Panel took an interest in this matter, even though monitoring was beyond its brief, but was unable to offer useful advice.

The Panel notes that the final Measure agreed by NEPC only provided for combustion thresholds (2a and 2b) for Particulate Matter and recommends that non-combustion thresholds for Particulate Matter be considered at a later stage, informed by the results of the various trials now being conducted.

5.5 Nutrients

Total nitrogen and phosphorus refers to the capacity of the emission to result in nitrates and phosphates in aqueous solution, and reporting is limited to those nitrogen and phosphorus compounds that give rise to nitrate and phosphate ions respectively. For the purpose of threshold determinations, and this is the same concept as for metals, the entire weight of the nitrogen or phosphorus compound must be included in calculations. For the purpose of reporting releases, only the weight of the nitrate and phosphate ions should be included in calculations. The reporting of these species thus differs from the approach described above for speciation in the reporting of releases of metals.

Some submissions questioned the inclusion of phosphorus, especially, on the NPI reporting list since it is a natural substance and is widely disseminated into the environment by a number of activities, and is not included in either the US or Canadian Toxics Release Inventory. The relevant activities in Australia include animal excretion (500,000 tonne), sewage (11,000 tonne), fertilisers (350,000 tonne) and other industries (5000-10,000 tonne), all calculated as elemental phosphorus. Surely, it was argued, if emissions from point sources such as sewage works, intensive husbandry as in pig and fish farms, abattoirs, and industrial facilities were to be monitored, then so should farms contributing run-off. The Panel, in considering the matter, noted that while environmental monitoring was expected to give information about the effect of diffuse sources such as agricultural land, it was nonetheless important for point sources to be reporting their emissions. The perspective

provided by the two types of monitoring could be used to confirm the minor role played by the latter.

Ammonia, although listed separately, would also contribute to total nitrate and so needs to be accounted for under this heading, as well. In the list, ammonia (total) refers to the total of both ammonia (NH_3 CASR number 7664-41-7) and the ammonium ion (NH_4^+) in solution.

5.6 Chlorine

Substances giving rise to chlorine, such as hypochlorite, should be included when determining whether the chlorine threshold has been exceeded, but emissions should be reported as chlorine.

5.7 Phenols

Because of great similarities in chemical and biological properties between phenol and simple substituted phenols (cresols and xylenols), and the fact that mixtures are often encountered in industrial applications, facilities may choose to consider all such phenols as 'phenol' when measuring against the threshold and when reporting their emissions.

5.8 2-Alkoxyethanols

The alkoxy ethanols were initially treated as a group, but it became clear that those with longer alkyl chains were markedly less toxic than their lower homologues. Examination of toxicological data contained in a substantial report (NICNAS Priority Existing Chemical Report No. 6, October 1996), enabled the Panel to score 2-methoxyethanol, 2-ethoxyethanol and 2-butoxyethanol separately, as a result of which only the first two found their way onto the reporting list. The propoxy homologue seems to be little used.

5.9 Acids

A number of acids are included in the reporting list. The panel discussed whether the concern which led to consideration of these substances was over their acidic nature, and potential for lowering pH of media and of inflicting chemical burns, or whether the non-hydrogen portions of the molecules - sulfate, chloride, acetate, nitrate and phosphate - were significant factors in their inclusion. Noting that the last two on this list would be reported under total nitrogen and phosphorus, the Panel affirmed that it was acidity that was the focus of consideration, and that any acid which had been neutralised should not be subject to reporting except to the extent that the neutral salt might come under some other heading.

5.10 Glutaraldehyde

It was contended, during the consultation period, that glutaraldehyde was so rapidly destroyed in the (aqueous) environment that it did not merit listing. In responding, the Panel noted that the scoring process had taken account of this low persistence attribute, but that other component scores (especially quantity released) had been substantial enough to see glutaraldehyde placed on the reporting list.

5.11 Vinyl Chloride Monomer

The converse situation was encountered with vinyl chloride monomer (VCM), which is handled in large quantities by the petrochemical industry and is known to be hazardous. Industry argued that earlier concerns about VCM had led to their operating in 'zero release' fashion and that this should have been reflected in low exposure scores and seen VCM relegated from the list. Others in the consultation period, possibly reacting to the past concerns which had brought about such good practice, pressed for retention of VCM on the list. The Panel agreed to retain the substance, but noted in correspondence that the users would appear in an excellent light if they were able to submit a 'nil' return for emissions despite handling large quantities of VCM and might subsequently mount a strong case against the current exposure score allocated by the Panel.

5.12 Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) in the atmosphere may react with nitrogen oxides in complicated fashion to produce ozone which, at low altitudes, is a serious pollutant. Substances which would be included in the

VOC category include aliphatic hydrocarbons (such as hexane), aromatic hydrocarbons (such as benzene, toluene, and the xylenes), and oxygenated compounds (such as acetone and similar ketones). The major industrial sources of VOCs in Australian cities are petrol refining and fuel storage, followed by motor vehicles themselves, and manufacturing industry. However, there are significant non-anthropogenic sources, since most state capitals are adjacent to areas of bush which emit volatile oils. In the Brisbane area, for instance, such sources contribute (and are expected to continue to contribute) 60% of the observed VOCs.

Notwithstanding this broad dichotomy of sources, aggregate VOC levels are measured or estimated/modelled in some jurisdictions, and it has been suggested that such a category should be included in the NPI. It is relevant to note, at this point, that VOCs are not included among the substances to be monitored under the proposed ambient air quality NEPM, which does, however, include nitrogen oxides (the co-reactant) and ozone (the product of the reactions).

The reporting list recommended by the Panel already includes a number of the anthropogenic VOC components: acetone, benzene, butadiene, methanol, methyl ethyl ketone, methyl isobutyl ketone, toluene and xylenes in the initial group, with acetaldehyde, cumene, cyclohexane, ethyl benzene, hexane, and styrene to be added the following year. Thus, it might be argued, that all or most of the substances of concern will be included in the NPI within a few years, thus giving the information which might have been achieved by the inclusion of a 'VOC' category.

A counter argument on this latter point, would be that it is nonetheless of interest to know the VOC total, since this represents the mass of substances that can take part in the ozone-forming reactions. There is a tacit assumption here, that each individual substance reacts in roughly the same fashion and that adding the amounts of the separate components without weighting them is a valid process. A further point to consider is that individual components of the VOC mix may fall below the threshold and so not be reported, even though the reactive total is large enough to be of concern.

Although no protocol was developed for scoring mixtures of diverse substances (as opposed to closely similar groups such as the xylenes or manganese compounds), it would seem appropriate to assign to the VOCs as a group a 'second order' score, in much the same way as was done for dissolved nitrogen and phosphorus species, which may give rise to nitrate and phosphate which produce undesired biological effects. When this procedure was followed for VOCs by taking toluene as a typical substance and replacing its 'environment' score with a score of 3 for the second-order effects, we derive an overall risk score of 9, roughly equivalent to those of xylenes and butadiene.

Such a procedure, basically sound although distinctly pragmatic, would put VOCs into the first reporting list.

Panel members differed on the merits of including VOCs, but there was a small majority for not including VOCs as a separate category, given that (i) so many of the important components would be the subject of separate reporting

in either the first or second stage of implementation of the NPI, (ii) non-anthropogenic sources of VOCs would be important in many areas, (iii) the co-reactants of VOCs, the nitrogen oxides, are included in the NPI as well as the ambient air quality NEPM, and (iv) the reason for monitoring and/or estimating VOCs was really the gaining of information about the formation of ozone; VOC concentration was a surrogate, albeit not a very good one, for ozone concentration, and in any case ozone was to be measured under the ambient air quality NEPM.

Having regard to these arguments, however, and realising that data on releases of VOCs could be compared with those gained through diffuse monitoring, it is clear that having VOCs on the reporting list does not in any serious way go against the advice of the Technical Advisory Panel.

Chapter 6

Agricultural and Veterinary Chemical and the National Pollutant Inventory

6.1 The General Approach

The Panel was asked to consider the issue of agricultural and veterinary (AgVet) substances in the context of the National Pollutant Inventory.

In reaching its position reported here, the Panel was obliged to review a number of issues of a policy nature relating to AgVet substances:

- a process for selecting AgVet substances;
- previous discussion of whether or not AgVets should be included in the NPI;
- other aspects of this issue not previously raised; and
- issues associated with who would report.

6.2 Selecting Agricultural and Veterinary Substances

The Panel's terms of reference state that it is to: develop criteria for the selection of substances; assess a range of substances against those criteria; and then recommend whether individual substances should be on a reporting list. Given that the Panel has been asked to consider AgVet substances, and putting related issues to one side for the moment, the Panel has attempted to meet its terms of reference by:

- examining the range of AgVet substances;
- considering criteria to assess those substances;
- evaluating different sets of criteria; and
- providing some conclusions on this for Project team and NEPC Committee consideration.

6.2.1 The range of Agricultural and Veterinary Substances

There is a national scheme for the regulation of Agricultural & Veterinary chemicals in Australia. It is administered by the National Registration Authority for Agricultural & Veterinary Chemicals (NRA), a statutory authority within the portfolio of the Ministry of Primary Industry and Energy. The NRA regulates AgVet chemicals up to the point of sale, but legislation regulating the control of use rests with the States and Territories.

There are some 600 chemicals currently registered in approximately 7000 products by the National Registration Authority (NRA). This figure does not include non-active product constituents. New actives are being added at a rate of 5-15 per annum. In the Panel's view, this NRA list would represent a reasonable 'universe of substances' in which to consider potential inclusions on an NPI reporting list. However, the task of compiling all of the toxicological and emission data necessary to screen and prioritise such a list of chemicals by the processes outlined in Chapters 1 and 2 would be greater than that for the industrial substances already considered and is well beyond the resources of this Panel, given its timeframe.

6.2.2 Prioritisation already achieved through ECRP

The NRA's Existing Chemicals Review Programme (ECRP) could serve as a preliminary screening tool to prioritise chemicals for an AgVet substance module in the NPI. The ECRP is a subset of the larger NRA list and represents those substances assessed to be of sufficient interest to be reviewed. The current ECRP is outlined in Appendix VIII.

In 1994-95, four agencies working with the Review Programme (NRA, Health, Environment, and Worksafe Australia) conducted an extensive review of their databases on AgVet substances prior to making priority recommendations to the NRA Board. After a further process of public nomination and consultation, the NRA Board published a priority list of 80 chemicals which would form the basis for the ECRP. Five of these chemicals were selected for the first review cycle (atrazine, mevinphos, parathion, parathion-methyl, and endosulphan). Following a further period of data call-in and public submissions, work has been proceeding on the formal review of these five chemicals. Final reports are expected to be published in 1997-1998.

Work has now also commenced on the data call-in phase for second cycle of eight chemicals (chlorpyrifos, chlorfenvinphos, demeton-S-methyl, diazinon, dichlorvos, ethylene dibromide, fenitrothion, and monocrotophos).

It should be noted that there may be no need to proceed to a formal ECRP review for some chemicals initially included in the priority list of 80 (notably the chlorinated cyclodiene insecticides), because regulatory actions to remove them from registration and use may have already overtaken events. It would therefore be questionable whether such chemicals should be included in an AgVet substance module of the NPI list, provided that such regulatory controls remove the potential for further environmental emissions.

6.2.3 Further criteria for Agricultural and Veterinary substances

If it were proposed to use the ECRP process to select the range of substances, consideration would need to be given to the criteria developed by the ECRP. The ECRP Programme has incorporated an objective and transparent prioritisation process which has been published. The process incorporates many of the elements of the Panel's preferred scoring process, although there are some important differences, because the Panel's criteria have been developed with industrial pollutants in mind and so might not be adequate for the selection of AgVet substances.

Despite the broad similarities, some elements of the ECRP prioritisation processes are different from, or additional to, those covered in Chapter 2. These include: separate scoring of occupational health and public health risks; consideration of the adequacy or completeness of the toxicological database; whether there have been international regulatory restrictions imposed; whether any problems with product efficacy had been identified; potential trade impacts where food commodities contain unplanned chemical residues, or where appropriate maximum residue standards (MRLs) have not been established by trading partners or the international community; and finally, community concerns about these issues as expressed in a public nomination process, which may be inappropriate in the NPI. In relation to hazard, the ECRP prioritisation process used a weighted scoring system which addressed: acute and chronic toxicity hazards to humans; ecotoxicological properties; environmental persistence, and bioaccumulation. It did not include a score analogous to the exposure or environmental fate score outlined in Chapter 2.

In addition, it seems likely that application of the reporting thresholds outlined in Chapter 4 could exclude most sources of potential environmental emission for AgVet substances from requirements to report.

The full detail of the ECRP prioritisation processes is attached at Appendix VIII.

In the work undertaken by the Panel, there were 45 chemicals with potential AgVet uses included in the master list on the basis of their PAAN scores or EC Risk Phrase listing. Of these, 19 were also included among the 80 chemicals in the ECRP priority list. However, with the exception of arsenic, 1,2-dibromoethane, and endosulphan, none of these AgVets achieved a high ranking on the NPI list, because of low estimates (in many cases zero, since they are no longer used) for the environmental exposure score. Furthermore, while AgVet substances could achieve relatively high scores on acute and chronic toxicity indices, effective regulatory oversight should have ensured that it would be less likely for AgVet substances still in wide-scale use to achieve high scores on the carcinogenicity and reproductive toxicity indices.

Should the decision be made to include AgVets in the NPI, and further technical work be undertaken, the Panel believes it may be preferable to adopt an approach to prioritisation which differs from that used in ranking other chemicals on the main NPI list.

6.2.4 Conclusions in selecting Agvet substances for the National Pollutant Inventory

The criteria developed for the industrial substances do not readily suit AgVet substances. Nonetheless the Panel has considered the application of the methodology developed in Chapters 1 and 2 of this report to AgVet substances and in doing so has identified a number of additional outstanding technical issues highlighted in 6.2.2 and in 4.3.

However there exists an established system for assessing the effects of AgVet substances in the NRA which could be used in place of the system adopted by the Panel as discussed in Chapters 1 and 2. It is quite feasible to generate a ranking using the criteria as outlined in Appendix IX, but this would require time and resources that were not currently available to the Panel.

6.3 Other issues impacting on the selection of agricultural and veterinary substances

In considering how to select AgVet substances for the NPI the Panel has come across a number of other important issues which would need to be considered before any decision can be made on how or whether to select substances for the NPI. These matters were not resolved by the Panel, and for the time being AgVets will not be reported under the NPI, but the points below need to be taken into consideration whenever this matter is reconsidered.

6.3.1 General considerations

In most instances, the use of AgVet chemicals constitutes a deliberate process of chemical application to crops, animals, soil, waterways in certain circumstances. It has been argued that, therefore, they are not emissions in the same sense as most NPI releases. However, because AgVet chemicals can represent significant emissions to the environment, particularly to off-target sites such as waterways and adjacent sites inhabited by people or livestock, strong expressions of 'community right-to-know' lead to pressures to include AgVet chemicals.

6.3.2 Veterinary substances

Veterinary chemicals have so far, in this chapter, not been considered as a distinct class within the broader group of agricultural and veterinary substances. This was possibly based on the perception that emission of veterinary chemicals to the environment is likely to be minimal. While this may be true for certain classes of veterinary chemicals (for example pet care and animal therapeutic products), it may not necessarily be true for chemicals used on a large scale in food-producing animals (for example: ectoparasiticide dips and sprays; growth promotants and other chemicals which may be present in animal excreta) or for those used in commercial aquaculture.

6.3.3 Domestic and other uses

Not all chemicals registered by the NRA are destined for use in broad scale agriculture or veterinary practice involving mass medication. Many of the pesticides registered by the NRA are used by professional pest controllers and the general public/workforce in the control of pest plants, animals and organisms in commercial buildings, in and around domestic premises and in areas under the jurisdiction of local governments. These chemicals may include: insecticides, termiticides, herbicides, turf pesticides and water treatment chemicals.

The Panel notes that, although no single domestic user is likely to approach the 10 tonne threshold, any future consideration of AgVets and thresholds for them would need to be mindful of domestic uses.

6.3.4 Non-active constituents

While the primary focus in AgVet chemical registration has conventionally been directed towards active constituents, it must be recognised that the concentration of active ingredients in AgVet products may only comprise a small percentage of the total. AgVet products are often formulated with a range of solvents, surfactants, dispersants, emulsifiers etc to improve their use characteristics. Sometimes these “inactive” ingredients may have significant toxicological properties in their own right. Often, the identity and composition of these formulation “inactives” is a commercially sensitive secret.

Sometimes the addition of a solvent occurs after the formulation and storage of the AgVet products, for instance, during use (eg: the preparation of sprays by dilution with aqueous and non-aqueous solvents such as petroleum distillates).

AgVet formulation ingredients (particularly organic solvents) may already be included in the NPI on the basis of their other industrial uses. Their presence in AgVet products may complicate the compilation of emission data. If AgVets are included in the NPI, then triggering a reporting threshold for an active may also require the inclusion of data on solvents or surfactants. On the other hand, if AgVet **actives** are not included in the NPI, manufacturers and users of AgVet products may be unaware of a reporting obligation if the volume of solvent or other “inactive ingredient” inadvertently exceeds reporting thresholds. Although this relates to how the information is reported it does impact on whether individual substances need to be given different thresholds.

6.4 Who would report?

In examining how AgVet substances might be selected for inclusion in an NPI reporting list the Panel also needed to consider the issue of who might report. Who reports is an important consideration in designing thresholds for reportable substances and AgVet substances bring different threshold considerations.

Whereas industrial substances, whose emissions can be considered for the most part pollutants, are generally emitted in the urban environment and at a reasonably constant rate, application and emissions of AgVet substances have a different pattern.

The potential emission to the environment of AgVet chemicals has few of the characteristics of point source emissions. While points of manufacture and/or formulation of AgVet products may be relatively discrete sites and susceptible to data collection processes applicable to other point-source NPI chemicals, potential AgVet chemical emission to the environment can also occur during transport, storage (both in distribution depots and in farmer/householder storage facilities), during application or usage, and ultimately by improper disposal of unused product or containers which may be “empty” or only partially empty.

In addition the Panel notes that many parts of this cycle are subject to regulatory control, albeit across different jurisdictions. Use patterns which have the highest potential for off-target dispersion (for example, a spray drift), and contamination of local water supplies (for example, ground water, reservoirs, streams, household tanks and bores) are likely to raise the most community concern and are probably of greatest significance in terms of the NPI.

The issue of how an NPI could capture useful data on the environmental emissions of AgVet chemicals is a difficult one to resolve in the context of developing thresholds for an NPI reporting list.

Application of the proposed general reporting thresholds (Chapter 3) would probably exclude individual farmers, spraying contractors and pest control operators from reporting obligations. It is clear that the NPI Reference Group considered this to be an important policy element since the NPI is not intended to be a burden on small business. This would leave manufacturers and larger distribution outlets as the main reporting sources. Data from such sources might lack regional focus and be difficult to relate to actual emissions to the environment. It is assumed that modelling techniques analogous to those used for estimating NPI diffuse emissions would need to be developed in order to collect regionally meaningful data on AgVet chemical emissions.

6.5 Conclusions

The Panel has considered the incorporation of AgVet substances into the NPI, and found that this can be done but that the scoring for these substances sits uncomfortably with that for more generally industrial substances. In contrast to the situation with these industrial substances, little prior work had been done on attempting to score and rank AgVet substances.

The Panel notes that in conjunction with decisions on how AgVet substances might be selected for inclusion in the NPI, other outstanding issues - often more of a policy nature than technical - would need to be resolved. The Panel recommends that the Committee should seek views on resolving these outstanding policy issues before commissioning the development of new or modified criteria suitable for selecting and ranking AgVet substances.