

I. INTRODUCTION

ANGUS Chemical Company (ANGUS) committed to provide screening level human health effects, environmental effects and fate, and physiochemical test data on 2-methyl-2-nitro-1-propanol and 2-(hydroxymethyl)-2-nitro-1,3-propanediol under the Environmental Protection Agency's (EPA's) High Production Volume (HPV) Challenge Program (Program). After this commitment was made ANGUS was bought by the Dow Chemical Company (DOW) and is now a wholly owned subsidiary of DOW.

This plan details how both substances can be placed in a single category, nitro alcohols, and identifies existing data of adequate quality for those substances. Because both nitro alcohols are structurally similar and are known to decompose releasing the same chemical, formaldehyde, they can be placed in a single category.

II. DESCRIPTION OF THE NITRO ALCOHOL CATEGORY

ANGUS Chemical Company is the largest producer of nitroparaffins in the world. Indeed, of those it manufactures, nitromethane, nitroethane, 1-nitropropane, and 2-nitropropane, only nitromethane is available from another producer. One use for these substances is the production of **nitro alcohols**, which are obtained by the reaction of the nitroparaffin with formaldehyde in the presence of base as a catalyst. The nitro alcohols obtained from each of the nitroparaffins are displayed in Table I.

Table I. Nitro Alcohols from the Nitroparaffins*

NITROPARAFFIN Precursor	formaldehydes added	NITRO ALCOHOL Obtained
Nitromethane 75-52-5	2	2-nitro-1,3-propanediol
	3	2-(hydroxymethyl)-2-nitro-1,3-propanediol
Nitroethane 79-24-3	2	2-methyl-2-nitro-1,3-propanediol
1-Nitropropane 108-03-2	1	2-nitro-1-butanol
	2	2-ethyl-2-nitro-1,3-propanediol
2-Nitropropane 79-46-9	1	2-methyl-2-nitro-1-propanol

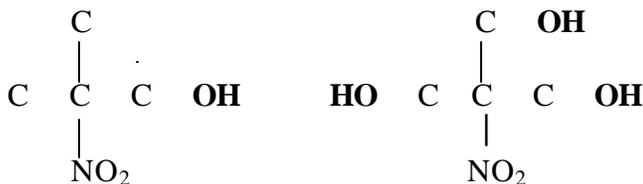
- Substances in bold are HPV substances

Of these substances only the following are High Production Volume chemicals:

	<u>CAS Reg. No.</u>
2-methyl-2-nitro-1-propanol (MNP)	76-39-1
2-(hydroxymethyl)-2-nitro-1,3-propanediol (TN)	126-11-4

Both are non-volatile crystalline solids.

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MNP (HPV)

TN (HPV)

III. TEST PLAN RATIONALE

A. Overview

Currently, all nitro alcohol production except that of **TN** is consumed (**site-limited**) by ANGUS for the production of amino alcohols by hydrogenation of the nitro group.

Adequate data are available for **TN**. Its major use is as a pesticide registered under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA). A Reregistration Eligibility Decision (RED) was published by EPA in 1993. Based on this RED, **TN** was affirmed as “safe and effective” as an antimicrobial agent for the control of bacteria in industrial processes. Efficacy as a biocide is obtained by the slow release of formaldehyde from **TN** in an alkaline environment.

A small amount of **TN** sometimes finds use as a cross-linker in industrial processes such as manufacture of plywood where it is used in the adhesive system. As part of the adhesive system, **TN** is mixed with wood fibers and resins and applied to an outer layer of paneling. As in its use as a pesticide, cross-linking actually is achieved by release of formaldehyde. In this instance, however, formaldehyde release is promoted by heat in the resin curing operation. Any exposure in the use of **TN** as a cross-linker is limited to potential dermal exposure in the formulation and handling of the adhesive. All the **TN** is consumed when heated in the curing ovens. None is retained in the cured resin. Because the use of **TN** as a pesticide, data beyond that of the HPV battery of tests are already available. **TN** is synthesized by the reaction of nitromethane with three moles of formaldehyde.

Only acute data are available for **MNP**; however, it now is used **exclusively** in a closed system process for the production of 2-amino-2-methyl-1-propanol (AMP). **MNP** is produced by reacting 2-nitropropane with one mole of formaldehyde. The **MNP** is then pumped to a closed tank. This tank is used to feed **MNP** into an autoclave where it is reduced with hydrogen to yield AMP.

In the past **MNP** did find use as an adhesion promoter in tire production, a use in which the substance is consumed; however, this process is no longer in use. No **MNP** is distributed in commerce.

Because these substances are non-volatile and are consumed in industrial processes, no exposure to the general public will result from their use. In the industrial environment exposure will be limited to dermal exposure which might occur in the maintenance of process equipment. Work rules, however, require that workers involved in such activities wear goggles, rubber gloves, and body protection so that even dermal exposure is limited. No oral or inhalation exposure will occur.

At neutral or basic pH and/or when exposed to heat, all these nitro alcohols readily hydrolyze to yield formaldehyde and their parent nitroparaffin. The nitroparaffins involved and formaldehyde are all HPV substances which are subject to separate submission.

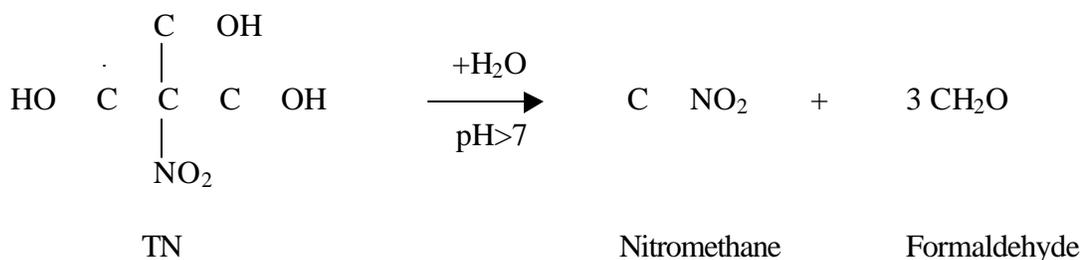
As **TN** is the only nitro alcohol for which there are any appreciable human and environmental exposures, it is the surrogate of choice for all of the nitro alcohols.

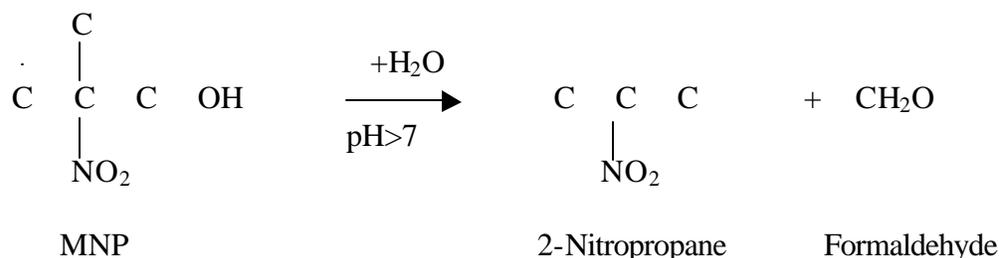
B. Physicochemical Properties

Extensive data already exist for all HPV endpoints. All members of this category are crystalline solids at room temperature, and all decompose with a significant release of energy at temperatures only slightly above their melting points.

C. Environmental Fate

The estimated half-life of photodegradation of **TN** was 5.6 days and that of **MNP** was 14 days (AOPWIN model). The nitro alcohols all undergo hydrolysis at pH ≥ 7 to yield formaldehyde and the nitroparaffin parent compound as follows:





Level I and level III fugacity-based models were used to evaluate the distribution of **TN** and **MNP** between environmental compartments. Based on the level III calculation, 77% of **TN** and 39.4% of **MNP** emissions will reside in water and 16.5% of **TN** and 43.4% of **MNP** will reside in the soil. Almost none of either substance will migrate to the air. In a ready biodegradation test (OECD 301F) only 13.4% of **TN** degraded within the time period measured. Thus **TN** and by analogy, **MNP**, are considered to be not readily biodegradable.

D. Ecotoxicity

Data on **TN** are available for all three aquatic toxicity endpoints in the HPV program. **MNP** is site-limited and therefore does not get released to waters. The LC_{50} of **TN** in the fathead minnow (*pimephales promelas*) was determined to be 280 mg/L using OTS protocol 797.1400. Using the procedure of OPP 72-2, the 48-hour EC_{50} for daphnia magna was 80 mg/L. An EC_{50} of only 0.656 mg/L for **TN** was obtained using the OECD 201 "Algae Growth Inhibition Test".

E. Animal Toxicity Testing

A complete battery of HPV animal toxicity studies already is available for **TN**. Only acute toxicological data and an AMES test are available on **MNP**. The oral LD_{50} for **TN** is 990-1000 mg/kg bw and that for **MNP** is 845-1480 mg/kg bw. These data do not indicate that there are differences in toxicity for the nitro alcohols which are great enough to warrant further testing of **MNP**. Both would be expected to be relatively stable in the stomach. Further down the gastrointestinal tract, in a basic environment, all these nitro alcohols will hydrolyze to release formaldehyde and a nitroparaffin. All the nitroparaffins are HPV chemicals and have been studied extensively. They all behave similarly when ingested.

The primary route of exposure to **TN** is the dermal route. Therefore, the 90-day repeat dose study was done by this route. At 1000 mg/kg/day, no systemic effects were evident from the histopathological examination of the rat organs including the gonads. Further, in oral teratology studies in rats and rabbits, no significant effects in fetal mortality, developmental anomalies, malformations, or litter numbers were noted at doses below those which induced maternal toxicological effects.

Neither **TN** nor **MNP** were mutagenic in the Ames test either with or without S9 activation. Further negative results were obtained for **TN** in the Chinese Hamster Ovary (CHO) test and the *in vitro* Unscheduled DNA Synthesis test.

IV. TEST PLAN SUMMARY

All data required for the HPV program are summarized in the IUCLID data set which accompanies this report. The two teratology studies conducted on **TN** and the 90-day dermal study suffice to fill the reproductive toxicity requirement.

Robust summaries for the nitro alcohol data as required for the HPV program as well as for addition studies follow in the IUCLID data sets. The references for the cited studies are found in them.

