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Table 1  
Impurities Present in TNT Prepared by Continuous Nitration and Purification <sup>a</sup>

| Compound  | Approximate maximum nominal concentration (%) <sup>b</sup> |          |
|---|--|----------|
|   | Crude  | Finished |
| 2,4,5-Trinitrotoluene   | 2.50   | 0.30     |
| 2,3,4-Trinitrotoluene   | 1.75   | 0.20     |
| 2,3,6-Trinitrotoluene   | 0.50   | 0.05     |
| 2,3,5-Trinitrotoluene <sup>c</sup>                                    | 0.05   | 0.05     |
| 2,6-Dinitrotoluene  | 0.25   | 0.25     |
| 2,4-Dinitrotoluene  | 0.50   | 0.50     |
| 2,3-Dinitrotoluene  | 0.05   | 0.05     |
| 2,5-Dinitrotoluene  | 0.10   | 0.10     |
| 3,4-Dinitrotoluene  | 0.10   | 0.10     |
| 3,5-Dinitrotoluene  | 0.01   | 0.01     |
| 1,3-Dinitrobenzene  | 0.02   | 0.02     |
| 1,3,5-Trinitrobenzene   | 0.15   | 0.10     |
| 2,4,6-Trinitrobenzyl alcohol  | 0.25   | 0.25     |
| 2,4,6-Trinitrobenzaldehyde  | 0.25   | 0.25     |
| 2,4,6-Trinitrobenzoic acid  | 0.50   | 0.05     |
| $\alpha$ -Nitro-2,4,6-trinitrotoluene                                 | 0.10   | 0.10     |
| Tetranitromethane   | 0.10   | none     |
| 2,2'-Dicarboxy-3,3',5,5'-tetranitroazoxybenzene<br>("white compound") | 0.35   | 0.05     |
| 2,2',4,4',6,6'-Hexanitrobibenzyl (HNBB)                               | none   | 0.40     |
| 3-Methyl-2',4,4',6,6'-pentanitrodiphenylmethane (MPDM)                | none   | 0.40     |
| 3,3',5,5'-Tetranitroazoxybenzene                                      | none   | 0.01     |

a Data from Radford Army Ammunition Plant, Radford, Va

b Concentrations listed are the maximum possible. Actual values will be much lower

c The 3,4,5-isomer has also been identified in crude TNT to the extent of 0.006% (Ref 11)

cited above. It was, therefore, decided to install a third washer to overcome this deficiency. In addition, the gravity separators will be replaced by dynamic separation, thereby greatly reducing the quantity of nitrobody in transit with a corresponding increase in safety

The ROF (British) TNT Process also employs continuous purification, using a compartmented reactor generally similar to that used by them for nitration (see section on "Preparation") (Refs 14 & 15). However, the TNT is contacted as a solid at 67.5°, rather than as a liq at > 80°, as in the American process. This is said to result in a higher yield of purer TNT with a require-

ment of about two-thirds as much Na sulfite. HNBB and MPDM are not formed. Advantage is taken of the fact that the unsymmetrical isomers form a eutectic which migrates to the crystal surface. This type of process is also employed in West Germany (Ref 24). It is operated batchwise, using 4–10p Na<sub>2</sub>SO<sub>3</sub> per 100p TNT, and with a reaction time of 30 mins. Use of this purification procedure, taken with a batch trinitration method which removes nearly all of the DNT isomers, yields a TNT of unusually high purity – ie, with a solidification pt of 80.65–80.80°. This type of process has also been used in the past in the USA