

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONE, CHENNAI

Original Application No. 95 of 2024 (SZ)

WITH

Original Application No. 138 of 2024(SZ)

WITH

Original Application No. 200 of 2024(SZ)

WITH

Original Application No. 201 of 2024(SZ)

In the matter of:

Tribunal on its own motion SUO MOTU based on the news item in India Today dt: 18.02.2024 titled, “10 killed in blast at Tamil Nadu firecracker unit several injured”.

Versus

Tamil Nadu Pollution Control Board and Ors.

...Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the News Item in The Hindu Chennai edition, Newspaper dt: 02.05.2024, under the caption, “ 3 Killed in explosion in Virudhunagar”.

Versus

Central Pollution Control Board and Ors.

...Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the news item appearing in NDTV.com dated 09.05.2024 titled, “8 killed in explosion at fireworks factory near Sivakasi in Tamil Nadu” and news item in The Hindu dated 10.05.2024 titled, “10 workers, including six women die in Sivakasi fireworks unit blast”

Versus

Tamil Nadu Pollution Control Board and Ors.

...Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the news item in The Hindu dt: 01.05.2024 titled,

“Three killed in blast at explosive storage unit in Virudhunagar”.

Versus

Tamil Nadu Pollution Control Board and Ors.

...Respondent(s)

**REPORT FILED BEHALF OF 2ND RESPONDENT –
DISTRICT COLLECTOR - VIRUDHUNAGAR**

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Through

Dr. D. Shanmuganathan

Standing Counsel of Tamil Nadu

National Green Tribunal

Southern Zone, Chennai

DATE: 11.12.2024

**BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI**

Original Application No.95 of 2024 (SZ)

[Earlier O.A.No.174 of 2024 (PB)]

WITH

Original Application No.138 of 2024 (SZ)

WITH

Original Application No.200 of 2024 (SZ)

[Earlier O.A.No.599 of 2024 (PB)]

WITH

Original Application No.201 of 2024 (SZ)

[Earlier O.A.No.542 of 2024 (PB)]

IN THE MATTER OF:

Tribunal on its own motion SUO MOTU based on the News Item in India Today, dt: 18.02.2024, titled, "10 Killed in blast at Tamil Nadu firecracker unit several injured"

Versus

Tamil Nadu Pollution Control Board and Ors.

....Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the News Item in The Hindu Chennai edition, Newspaper dt: 02.05.2024, under the caption,' 3 Killed in explosion in Virudhunagar

Versus

Central Pollution Control Board and Ors.

....Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the News Item appearing in NDTV.com dated: 09.05.2024 titled, " 8 Killed in explosion at fireworks factory near Sivakasi in Tamil Nadu" and news item in The Hindu dated 10.05.2024 titled, " 10 workers, including six women die in sivakasi fireworks unit blast"

Versus

Tamil Nadu Pollution Control Board and Ors.

....Respondent(s)

WITH

Tribunal on its own motion SUO MOTU based on the News Item in The Hindu dt: 01.05.2024, titled, " Three Killed in blast at explosive storage unit in Virudhunagar

Versus

Tamil Nadu Pollution Control Board and Ors.

....Respondent(s)

JOINT REPORT FILED BY THE
DISTRICT REVENUE OFFICER, VIRUDHUNAGAR AND
JOINT DIRECTOR , DIRECTORATE OF INDUSTRIAL SAFETY AND
HEALTH, VIRUDHUNAGAR.

- 1) I, R.Rajendran, S/o V.Raman, Hindu, aged about 54 years, presently working as District Revenue Officer, Virudhunagar District.
- 2) I, E.Velmurugan , S/o R.Elumalai, Hindu, aged about 56 years, presently working as Joint Director, Directorate of Industrial Safety and Health, Virudhunagar District.

The Hon'ble National Green Tribunal Southern Zone, Chennai has issued Suo Motu Case No. Original Application Nos. 95,138, 200 & 201 of 2024 (SZ) order, dated.22.08.2024, it has Directed to the Revenue authorities as well as the Inspector of Factories to file a detailed report after making a study to avoid any kind of accidents happening in these fire cracker units. Hence the respondents do here by submit the following points for due consideration.

It is respectfully submitted that, Virudhunagar District is not agriculture dependent; it is prominent for the production of matchboxes and fireworks. The fireworks units were started by the industrialists of Standard, Kalishwari, and National (Ayyan) Fireworks in 1934. Later, it grew into a business hub for many industrialists. Matchboxes and fireworks produced in and around Sivakasi are not only supplied throughout India but also exported to many countries. As of now, there are more than 1,000 fireworks/sparklers/amerces units operating in Virudhunagar District. This industry directly and indirectly employs more than a lakh worker and provides livelihoods for the workers and their families.

A. Introduction to fireworks:

- Low hazard explosive comprising of any composition or device manufactured with a view to produce colored fire or flame, light effect, sound effect, smoke effect (colored or natural), or combination of such effects and includes fog-signals, fuses, such as quick match and micro cord as per Rule 2 (24) of Explosives Rules (ER) 2008.
- "Aerial fireworks" means low hazard explosives, which moves by its own propulsion or shots into the sky through a mortar consisting of paper tube or casing filled with combustible material to deliver sound and pyrotechnic effect and includes shells and rockets.
- Fireworks composition means any chemical compound or mechanically mixed preparation of an explosive or inflammable substance that is used for the purpose of making manufactured

fireworks and is not included in any other class of explosives, and includes any star or colored fire composition as per Rule 2 (25) of Explosives Rules (ER) 2008.

It is respectfully submitted that, majority of fire accidents have happened to the industries in manufacturing process. Due to causative factors.

A. Common and Probable Causes for Accidents:

1. Friction and impact
2. Decomposition of fireworks composition (Tipping composition of chakra, and colour pellets / crackling composition) and twinkling star composition.
3. Using of Iron implements for fuse cutting and Iron nails, straps used in wooden cases and use of Iron sieves in sieving implements.
4. Using of Organic solvents in preparation of pellets.
5. Mishandling of vessels by workers in chemical mixing and filling sheds.
6. Using of red bricks for polishing the Knife which is used for fuse cutting purpose.
7. Entry of grit and foreign particles in the fireworks composition.
8. Manufacturing of unauthorized fireworks composition using Unapproved Chemicals.
9. Due to static charge.
10. Dust explosion.
11. Due to heat sources/open flames.
12. Entry of rain water and absorption of moisture by fireworks composition / pellets.
13. While ramming the dry fireworks composition.
14. Lightning.

(b) Static electricity is another main cause for accident

- Generation of static electricity is prone in presence of metal powder. Synthetic clothes/paper/film. The static electricity is created by the movement of particles of metal powder against any inert surface.
- Buildup of static electricity will be more in low relative humidity. Workers should not be allowed to wear synthetic clothes and to use plastic paper or film in the manufacturing shed.
- They should not allow the formation of dust in fireworks composition, since static electricity is developed more in dust atmosphere.

(c) Accident due to Human Errors

- Some of the causes of accidents are attributed to following faulty human factors such as over confidence and carelessness of workers, adapting to short cut method, ignorance and negligence, physical inability, bad habits, lack of co-ordination etc.
- No manufacturing activity shall be done during raining and lightning.
- No testing of fireworks shall be done within the vicinity of the shed.
- No cigarette / beedi / cell phone / match box / radio shall be permitted in the factory premises.
- No mixing operation shall be done when Relative Humidity is below 45%, especially between 12 noon to 2.00 PM when the temperature is high.
- No mixing operations shall be done in the ingredients shed itself.
- No storing of residual chemicals in sheds.

B. Comparative study with other International practices with regard to fireworks manufacturing

Though the respondents do not have the first hand exposure to safe practices in fireworks in other countries, some facts may be compared through available literatures and international standards.

A. Anti static Rubber flooring – A must protection to counter the effect of static electricity.

(i). National Fire Protection Association (NFPA 1124)- A code for the manufacture, Transportation, Storage and retail sales of fireworks and pyrotechnic Articles, which is world's highly regarded International standard for fireworks prescribes the following guide lines to combat Anti -static problems in fireworks manufacturing.

Chapter 4.5.2.2 :-

Floor and work surfaces in mixing and loading buildings for salute powder (flash powder) shall be of conductive materials (**Annexure – I**)

(ii) present status in fireworks:

- The mixing and loading rooms are laid with non conductive rubber sheet which serves to give cushioning effect to nullify any friction or impact effect.
- Without rubber sheet, the mere concrete floor would serve as a conducting surface though It is a bad conductor, but the sources of ignition like friction or impact components would come into play.
- Hence a Rubber sheet having combination effect on nullifying static electricity and friction / impact effects is highly warranted. Hence laying of floors of such rooms with Anti static rubber sheet with proper conductance / resistivity after detailed study is the need of the hour.
- Presently PESO issues licences with an additional condition Such as ' Antistatic flooring for the rooms where mixing / filling or pellet making are carried out' (**Annexure-II**) and it may be adhered to.

B. Shadow platform meant for drying pellets:-

Once pellet is made for fancy crackers, it is dried through sequence of events

First stage : Drying in shade (under shadow platform)

Second stage : drying in open air/Sunlight

Third stage : cooling again in transit room

- The first stage drying in shade is to be obtained through drying in shadow under shadow platform. It is done for uniform drying of pellet from within. If it is dried in the open sunlight soon after making wet pellet, the outer layer of pellet would dry faster than the core & leads to invisible hairline cracks on outer layer. This will aid in faster decomposition of pellets from the moisture within the core and hence the accidents.
- The present shadow platform as allowed by PESO is of such design that for most part of the day time, the Sunlight falls on the platform under the roof and negates its very usage what it is designed for (Sample shadow platform in **Annexure – III**)
- PESO may allow the re designing of the height of the walls & extension of sloping roof of the shadow platform to serve the purpose.
- The very concept of shadow drying is very much advocated by Dr. Takeo Shimizu, PHD., Engg., who is otherwise called ‘ **the father of pyrotechnics**’ in his literature titled
“FIREWORKS -The Art, Science and technique “-
 (PYROTECHNICA PUBLICATIONS)
(Enclosures as in Annexure IV)

C) Safe operating procedures in handling chemicals:-

Earlier, the fireworks industries made conventional crackers like chakra, flowerpots, chorsa, etc., those times the variety of chemicals used is limited to well known chemicals such as Aluminium, sulphur, Potassium nitrates and other such as charcoal, Dextrin, etc.. But due to evolution of the industry into making of fancy crackers like aerial shots, multi shots with coloured stars etc., it ventured into using more advanced chemicals like Magnesium, Magnalium, and titanium and variety of oxidising agents like strontium nitrate and other nitrates for giving effect to coloured stars. These formulations and process thereof have been fully self evolved by the manufacturers either by having various trials to get desired effects or by adopting formulation from abroad.

The formulations and the process adopted by the industry have never been put into scrutiny for safety and compatibility. Hence it is high time, that safe operating procedures for each chemicals and process thereof may be decided in line with the guidance of the explosive authorities who are the Guiding spirit behind pyrotechnics in fireworks, further, it would help other stake holders like DISH etc., in creating awareness and aid in their efforts in reduce the accidents.

D. Further Suggestive measures to avoid the accidents in fireworks industries:

1. Laying of Antistatic rubber sheets in mixing, filling and pellet making sheds may be emphasized as per the guidelines of PESO. Further suitable amendments in Tamilnadu factories rule 95 schedule XXIV item 3 (f) may be suggested.
2. PESO may allow the manufacturers to modify the shadow platform to be redesigned or else the existing structures may be suggested to have slight modification to serve the purpose.
3. There exists dearth of expertise in pyrotechnic knowledge among all the stake holders like Revenue, DISH & PESO officials. Since in India, No curriculum offers courses or technical inputs in Pyrotechnic chemistry.

Hence, it is high time to seek the help of **internationally accredited pyrotechnic experts** to aid in

- (i) **Assessing the suitability and adequateness of the existing structures in fireworks.**
- (ii) **Assessing the compatibility of process in fireworks manufacturing, since the process now being adopted is self evolved one and the formulations are adopted from abroad to suit the indian needs. But it has never been tested for its trustworthiness and safety.**
- (iii) **Training the stake holders on the safe manufacturing process in fireworks industries.**

- (iv) **Assessing the compatibility of the pyro chemicals and its combination and also of its process flow in manufacturing.**

It is therefore prayed, that this Hon'ble Tribunal may be pleased to accept the report, consider the aforementioned facts of the case, and thus render justice.

Date: 27.09.2024.



**Joint Director,
Directorate of Industrial Safety and
Health (DISH)
Virudhunagar.**




**District Revenue Officer,
Virudhunagar.**


VERIFICATION

- 1) I, R.Rajendran, S/o V.Raman, Hindu, aged about 53 years, presently working as District Revenue Officer, Virudhunagar District.
- 2) I, E.Velmurugan, S/o R.Elumalai, Hindu, aged about 56 years, presently working as Joint Director, Directorate of Industrial Safety and Health, Virudhunagar District.

Solemnly affirm that the contents of this report are true to the best of our knowledge based on the records and we have not suppressed any facts.

Date: 27.09.2024.


**Joint Director,
Directorate of Industrial Safety and
Health (DISH)
Virudhunagar.**


**District Revenue Officer,
Virudhunagar.**

NFPA 1124
Code for the
Manufacture, Transportation, Storage, and Retail Sales of
Fireworks and Pyrotechnic Articles
2006 Edition

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This edition of NFPA 1124, *Code for the Manufacture, Transportation, Storage, and Retail Sales of Fireworks and Pyrotechnic Articles*, was prepared by the Technical Committee on Pyrotechnics and acted on by NFPA at its June Association Technical Meeting held June 6-10, 2005, in Las Vegas, NV. It was issued by the Standards Council on July 29, 2005, with an effective date of August 18, 2005, and supersedes all previous editions.

This edition of NFPA 1124 was approved as an American National Standard on August 18, 2005.

Origin and Development of NFPA 1124

NFPA 44A was originally developed by the Technical Committee on Explosives of the NFPA Committee on Chemicals and Explosives. It was adopted as a Tentative Code at the 1972 NFPA Annual Meeting. It was further revised and officially adopted at the 1973 NFPA Annual Meeting. A revised edition was adopted in 1974.

In 1980, the Technical Committee on Explosives and the Committee on Pyrotechnics voted to transfer responsibility for NFPA 44A to the Committee on Pyrotechnics. The Correlating Committee on Chemicals and Explosives concurred and petitioned the NFPA Standards Council to effect the change. The Standards Council approved the change in June 1981.

The 1984 edition of NFPA 1124 was the result of a complete review of the 1974 edition of NFPA 44A by the Committee on Pyrotechnics, including the redesignation of the document as NFPA 1124 for consistency with the designations for other documents relating to pyrotechnics.

The 1988 edition of NFPA 1124 was the result of a thorough review of and partial revision to the 1984 edition of NFPA 1124 by the Technical Committee on Pyrotechnics, including reference updating and incorporation of the latest separation distances as approved by the Institute of Makers of Explosives in May 1983. It included new provisions for salute

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manufacturing and storage of salute powder.

The 1995 edition of NFPA 1124 included partial amendments to the document and editorial revisions, improving its ability to be used, adopted, and enforced and making it conform with the NFPA *Manual of Style*. The Committee incorporated the latest separation distances as approved by the Institute of Makers of Explosives in June 1991. The Committee also updated the definitions of fireworks to be consistent with the new terminology used in the U.S. Department of Transportation regulations that incorporated the United Nations shipping designations for fireworks (explosives).

For the 1998 edition, the requirements for fireworks laboratories were clarified by the addition of a definition and clarification of the storage and separation distances that are appropriate for them. The Committee added an appendix that extracts language from the American Pyrotechnics Association Standard 87-1 to provide users of this document with the approved definitions used in the Federal Regulations for fireworks, novelties, and theatrical pyrotechnics.

4.4.2.1 All roads leading into the plant shall be provided with gates that shall be kept closed and locked at all times when not used for entry or exit.

4.4.2.2 Vehicle access to the plant shall be restricted to roadways by means of a fence, natural barriers such as trees, and culverts, or by other means.

4.4.2.3 If the main plant entrance is in full view of and under the observation of an authorized responsible employee or guard, the main plant entrance shall be permitted to be left open during regular plant operating hours.

4.4.2.4 Only authorized employees or representatives of federal, state, or local agencies having jurisdiction over the plant shall be permitted inside the plant without special permission of the person in charge.

4.4.3 Signage. Conspicuous signs that read as follows shall be posted at the entrance and along the fence or barrier:

WARNING: NO SMOKING — NO TRESPASSING

4.5 Construction.

4.5.1 Process Building.

4.5.1.1 Process buildings shall be single-story buildings and shall not have basements.

4.5.1.2 Wall joints and openings for wiring, plumbing, and other utilities shall be sealed to prevent the entry of dusts.

4.5.1.3 Horizontal ledges and surfaces upon which dust can settle and accumulate shall be minimized.

4.5.2 Floors and Work Surfaces.

4.5.2.1 Floors and work surfaces shall not have cracks or crevices in which explosives or pyrotechnic compositions can lodge.

4.5.2.2 Floors and work surfaces in mixing and loading buildings for salute powder shall be of conductive materials.

4.5.2.3 Conductive footwear or other grounding techniques for personnel shall be used wherever exposed salute powder is present.

4.5.3 Heating, Lighting, and Electrical Equipment.

4.5.3.1 Stoves, exposed flames, and portable electric heaters shall be prohibited in any building where fireworks, fireworks components, or flammable liquids are or can be present.

4.5.3.2 Heating shall be provided by steam, hot water, indirect hot air radiators, or any other means acceptable to the AHJ.

4.5.3.3 Unit heaters located in buildings that contain exposed explosive or pyrotechnic

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Annexure - I

composition shall be equipped with motors and electrical devices for use in hazardous locations in accordance with Article 502 of NFPA 70, *National Electrical Code*.

4.5.3.4 All wiring, switches, and electrical fixtures in process buildings shall meet the requirements for hazardous locations in accordance with Article 502 of NFPA 70, *National Electrical Code*.

4.5.3.4.1 Portable lighting equipment shall not be used, unless under both of the following conditions:

- (1) Listed portable lighting equipment shall be permitted to be used during repair operations.
- (2) The repair operations area shall be cleared of all pyrotechnic or explosive materials and all dust or residue shall be removed before portable lighting equipment is used.



Additional Conditions

The Following are the additional conditions of licence number E/SC/TN/20/179(E12581) to manufacture fireworks in Form LE-1 [Articles no. 1(b) and (c) schedule IV Part 1 of Explosives Rules, 2008] granted by the Chief Controller or Controller of Explosives.

1. All licensed premises shall be provided with smooth pathway inter connecting mixing, filling, manufacturing sheds, drying platforms, transit sheds and burning pits to facilitate for safe and smooth movement of chemicals, intermediates, semi-finished and finished fireworks in light weight trolley, having rubber lined wheels and for the passage of workers.
2. All licensees shall make Safety Management Plan of their factory including names of all Foreman appointed and delegation of supervision and submit the same to the inspecting authority.
3. All licensees shall submit the detailed list of fireworks items manufactured by them indicating names of chemicals and exact compositions and Chief Controller of Explosive, Nagpur's approval undertaken for manufacturing in their fireworks factory to the inspecting office as well as the Licensing Authority.
4. The occupier of the fireworks manufacturing factory will ensure that dangerous practices like exceeding man limits in mixing and manufacturing/finishing sheds, filling sheds, drying platforms or Packing sheds and excess storages of semi finished items as well as pellets, usage of the area in between the sheds for manufacturing/storage of fireworks or semi finished items or drying of fireworks items are not resorted to at any time.
5. The occupier of the fireworks manufacturing factory shall ensure that all the employees of the fireworks manufacturing factory shall be conversant with the procedure to be observed during the emergency within the premises.
6. All licensees shall provide :
 - a. Cotton clothes without pockets for the workers who are engaged in the manufacturing of fireworks
 - b. Static discharge plates with efficient earthing points at all entrances of mixing/filling and pellet making rooms and all workers shall be made aware of their use before entering into the shed.
 - c. Anti-static flooring for the rooms where mixing/filling or pellet making are carried out
 - d. Light weight trolleys with rubber lined wheels for movement of chemicals semi finished as well as finished fireworks within the factory or upto the storage magazines.
7. The occupier of the fireworks manufacturing factory shall ensure that the fence provided at outer safety distance of the manufacturing factory shall be fully secured and strengthened by providing industrial type chain link fencing or compound wall so as to prevent entry of unauthorized persons into the licensed factory area under any circumstances.

For Joint Chief Controller of Explosives
South Circle, Chennai

Note :- This is system generated document does not require physical signature. Applicant may take printout for their records.

Annexure
II

Digitally signed by S KANDASAMY
Reason: Licence No. : E/SC/TN/20/179
Location: Sivakasi (E12581)
Date: 29-07-2024 17:43:56 PM





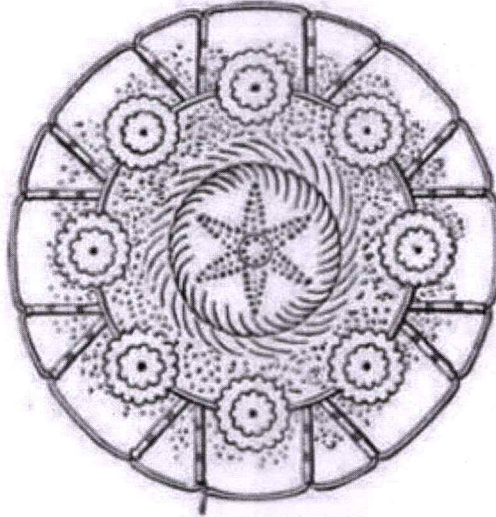
FIREWORKS

The Art Science and Technique

by

TAKEO SHIMIZU, PH.D., ENGINEERING

Director of Koa Firework Co., Tokyo
Former Manager - Director: PL Firework Co., Osaka,
and
Hosoya Firework Co., Tokyo



Annexure - IV

MCMXCVI

PYROTECHNICA PUBLICATIONS

AUSTIN

TEXAS

U.S.A.

The thickness of the layer pasted at a time varies according to the kind of composition. Blackpowder-type compositions and compositions which

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contain flake aluminium powder affect the grains as a kind of lubricant and the grains slip across each other and catch quite a small amount of the composition. In this case the grains grow quite slowly. On the other hand other compositions generally allow the grains to grow quite rapidly. The thickness that can be placed on the surface of the grains in the latter case, depends upon the degree to which the water has soaked into the grains and weather conditions. In strong sunshine, if the wet pasted layer is too thick, the surface of the grains dries before the inner moisture has been driven out. Under these conditions the moisture remains in the grains for a long time. This is called "Driven in". On the other hand in weak sunshine it is possible to increase the thickness of the layer in the one operation. Thus the growth of the grains at a given time may be about 0.5-1.0 mm in the case of blackpowder-type compositions or the compositions which contain flake aluminium and 1-2 mm for other compositions.

Generally the pasting can be done 2 times on a fine day in March, 2-3 times in May, 3-4 times on hot days in July and August. It is necessary to stop the pasting at about 2-3 o'clock and to dry the grains well before they are stored.

The completed stars vary in grain size, and for good display effect we must select the grains passing through particular sieve sizes.

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When the Toro is left for a long time, it generally loses its viscosity due to the degeneration of the glutinous rice starch and by the action of the other component materials (Table 15). It must be renewed as far as possible.

In the manufacture of elaborate colour changing stars, we put a layer called "Changing Relay" between two colour layers in order to create the illusion that all the stars change their colour clearly and simultaneously in spite of the deviation in burning. The composition of the changing relay must produce a weak light of neutral colour and is set out as follows:

Changing Relay I	
Potassium perchlorate	35%
Potassium nitrate	35%
Hemp coal (or Paulownia coal)	24%
Soluble glutinous rice starch	6%
Changing Relay II	
Potassium perchlorate	81%
Accroides resin	13%
soluble glutinous rice starch	6%

When round stars are manufactured from rape-seeds, sand gra

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