STANDARD OPERATING PROCEDURE (SOP) FOR COOL ROOF COATING APPLICATION

TNGCC
Tamil Nadu Green Climate Company

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India and Bhutan

Tamil Nadu Climate Change Mission

Auroville Consulting

STS

STANDARD OPERATING PROCEDURE (SOP) FOR COOL ROOF COATING APPLICATION

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Embassy of Switzerland in India and Bhutan

"Our Government is committed to building a climate-resilient and people-centric Tamil Nadu. As rising temperatures become a growing concern, solutions like cool roofs can greatly improve thermal comfort and wellbeing. This Standard Operating Procedure (SOP) is a step towards making such climate-friendly interventions accessible, scientific and scalable across the State. Together, we must move towards a cooler and healthier Tamil Nadu."

Thiru. C. Joseph Vijay
Hon'ble Chief Minister of Tamil Nadu

"Tamil Nadu has taken a leadership role in advancing climate responsive, people centric development, and this Cool Roof Coating SOP is a significant step in that direction. Standardising procedures for affordable, high impact cool roof interventions in housing, schools, and public buildings, will help in reducing indoor heat stress, improving thermal comfort, and shall contribute to cleaner, more sustainable growth for our state."

Dr. V. Rajeev

Hon'ble Minister Environment and Climate Change,
Government of Tamil Nadu

"Tamil Nadu is at the frontline of the climate crisis, and our response must be both scientifically sound and deeply humane. This Standard Operating Procedure on Cool Roof Coating Application is more than a technical manual; it is a concrete instrument to safeguard our children, the elderly, and vulnerable communities from dangerous heat. By codifying clear, field-ready processes—from roof preparation to quality assurance and maintenance—it empowers engineers, teachers, administrators, and frontline workers to deliver measurable relief from heat stress in homes, schools, and public buildings. I am confident that the widespread adoption of these guidelines will not only reduce indoor temperatures and energy demand, but will also demonstrate how a state can translate climate ambition into tangible, life-enhancing action on the ground."

Tmt. Supriya Sahu, IAS

Additional Chief Secretary to Government,
Environment, Climate Change and Forests Department

"UNEP is pleased to partner with the Government of Tamil Nadu and the Tamil Nadu Green Climate Company in advancing passive cooling solutions that deliver both climate and development benefits. This Cool Roof Coating SOP translates global best practices into a practical, scalable framework for implementation, and we hope it will serve as a model for other regions seeking to reduce heat risk, lower emissions, and enhance the well being of communities."

Dr. Balakrishna Pisupati

India Head, United Nations Environment Programme (UNEP)

Acknowledgement

This Standard Operating Procedure (SOP) on Cool Roof Implementation has been developed under the guidance of the Government of Tamil Nadu through the Tamil Nadu Green Climate Company (TNGCC) and the Tamil Nadu Climate Change Mission (TNCCM), with technical support from the United Nations Environment Programme (UNEP). The SOP has been prepared as part of the BeCool Project, funded by the Swiss Agency for Development and Cooperation (SDC), to advance sustainable cooling and climate-resilient development across Tamil Nadu.

We acknowledge the visionary leadership and guidance of Tmt. Supriya Sahu, I.A.S., Additional Chief Secretary to Government, Environment, Climate Change and Forests Department, Government of Tamil Nadu and the support of Thiru. Anurag Mishra, I.F.S., Special Secretary, Environment and Climate Change; Tmt. Asha Ajith, I.A.S., Managing Director, TNGCC; and Thiru. Jagadeesh Bakan Sudhakar, I.F.S., Chief Executive Officer, TNGCC, in steering this initiative.

We also acknowledge the valuable contribution of Auroville Consulting (AVC), particularly Mr. Martin Scherfler, Executive Director, and Seeds Technical Services (STS), particularly Dr. Anshu Sharma, Co-Founder, in supporting the development of this SOP.

This document reflects the collaborative efforts of government agencies, technical experts, and development partners working together to promote sustainable cooling practices and climate-resilient infrastructure in Tamil Nadu.

Content

Introduction

The Tamil Nadu Green Climate Company (TNGCC) pioneers the testing and deployment of innovative cooling solutions across the state. One of the most promising initiatives is the implementation of cool roofs. These solutions not only drastically reduce heat but also remain cost-effective, making them suitable for widespread adoption.

The Government of Tamil Nadu, through the Environment, Climate Change and Forests Department (ECCFD), has been promoting climate-responsive and sustainable built environments through targeted initiatives across the state. As part of this initiative, passive cooling strategies, particularly cool roof coatings, are being implemented to reduce heat exposure and improve classroom thermal comfort. Cool roofs reflect solar radiation and minimise heat absorption, lowering indoor temperatures during peak summer conditions.

This SOP provides standardised guidance on roof preparation, application, quality control, safety, and maintenance of cool roof coating systems to ensure consistent and effective implementation across building types.

Passive Cooling through Solar Reflective Paints

Passive cooling using solar reflective paints, also known as cool roof paints, is an effective way to lower cooling needs in Tamil Nadu. Designed to reflect up to 80% of incident radiation, these paints greatly decrease heat absorption by building surfaces, resulting in cooler indoor temperatures and less dependence on mechanical cooling. By reducing heat gain, solar reflective paints enhance building energy efficiency and help decrease carbon emissions.

Recognising rising temperatures and climate risks, the Government of Tamil Nadu has implemented cool roofs and related passive cooling measures in schools and affordable housing projects as a key response.

In 2023, TNGCC signed a Memorandum of Understanding (MOU) with the United Nations Environment Programme (UNEP) to implement passive cooling solutions in the state. Following this MOU, TNGCC launched a pilot implementation phase in affordable housing projects and selected Green Schools to test cool roofs and complementary passive measures under real operating conditions, refine technical specifications, and establish monitoring and evaluation protocols.

The Lighthouse Resettlement Project of the Tamil Nadu Urban Habitat Development Board in Perumbakkam served as a cool roof pilot project implemented by UNEP and RMI in collaboration with TNGCC. Following implementation, monitoring results indicated a reduction in rooftop surface temperatures ranging from 4.5°C to 8°C, while the ceiling (underdeck) temperature beneath the coated roof was reduced by 1.5°C to 3°C[1].

PILOT SITE

Lighthouse Resettlement Project, Perumbakkam, Tamil Nadu

AREA COVERED
1,000 sq.m
(Roof & parapet walls)

BASELINE & MONITORING

Two tenements were chosen for baseline assessment and ongoing monitoring of heat gain using sensors

120
HOUSES COVERED

COOL ROOF INTERVENTION

Solar reflective paint with Solar reflective index (SRI) of
102
(as per ASTM E1980)

~500
RESIDENTS BENEFITED

IMPACT DURING PEAK SUMMER

ROOF SURFACE TEMPERATURE

Baseline

Cool Roof

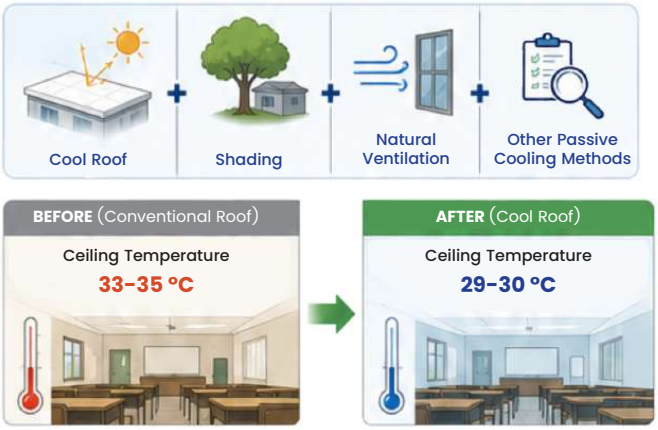
CEILING (UNDERDECK) TEMPERATURE

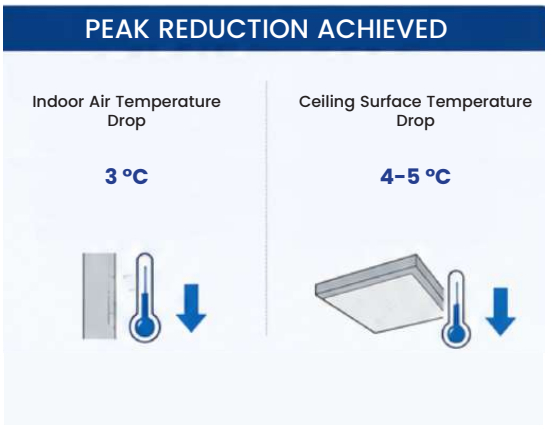
Baseline

Cool Roof

[1] Turning down the Heat

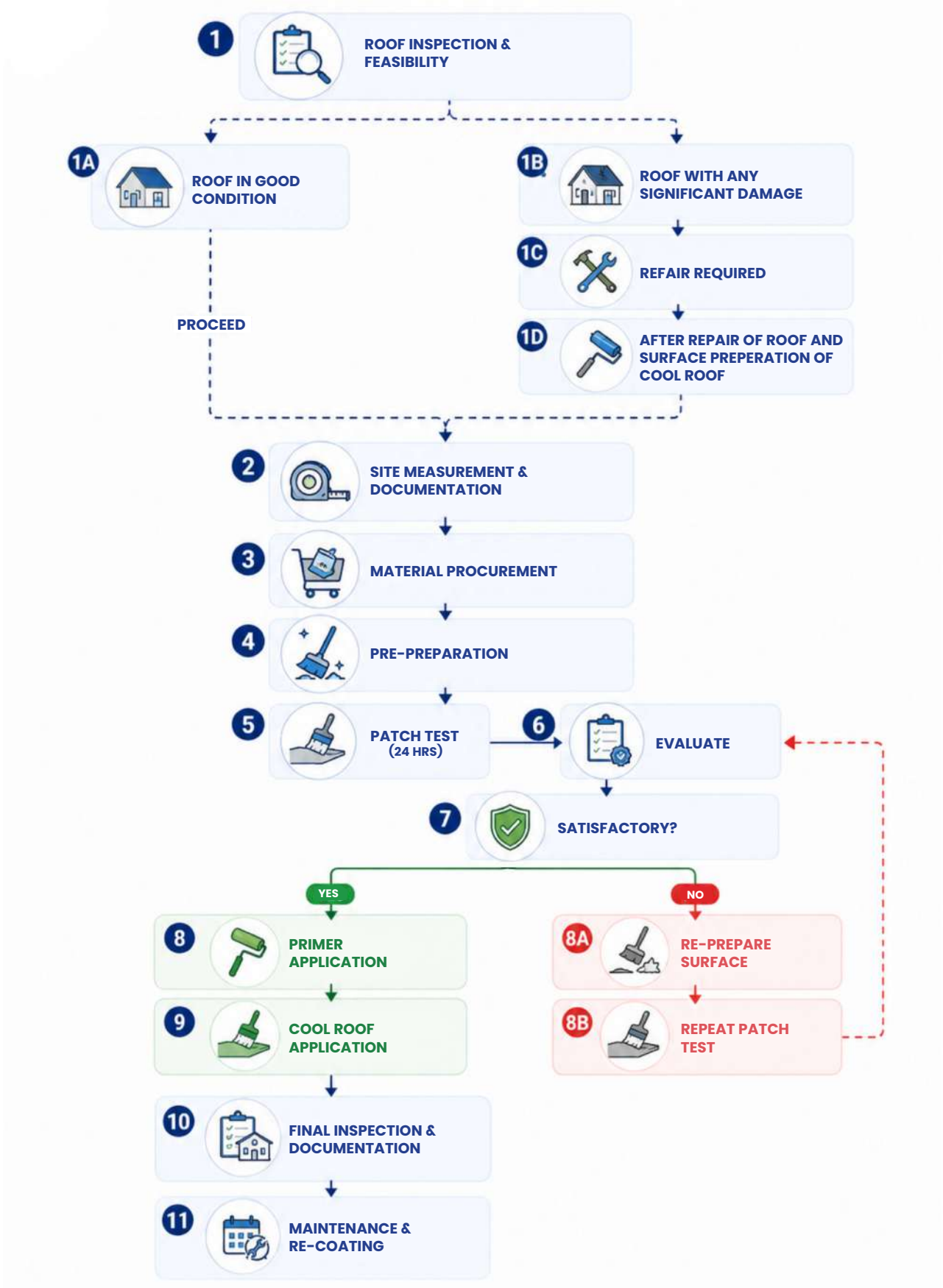
Under the Tamil Nadu Green Schools Programme of the Tamil Nadu Climate Change Mission, cool roofs are emphasized alongside shading, natural ventilation, and other passive cooling methods. At the Perunthalaivar Kamarajar Government Girls Higher Secondary School in Ambattur, a pilot cool roof project reduced ceiling surface temperatures by 4–5°C and lowered classroom temperatures up to 3°C effectively[2].





[2] Mainstreaming Passive Cooling in Greenv Schools

Process Flow for Cool Roof Coating Application



Why Cool Roofs Matter

Heat ingress through roofs is one of the primary causes of indoor heat stress, particularly in hot and humid regions where buildings retain heat and remain warm through the night. With climate change increasing the frequency and intensity of extreme heat events, Tamil Nadu has recognized heatwaves as a state-specific disaster, underscoring the growing need for effective heat adaptation measures. In dense urban and peri-urban areas, heat-absorbing surfaces further intensify the urban heat island effect, increasing ambient temperatures and prolonging heat exposure.

Extreme heat can lead to heat exhaustion, dehydration, cardiovascular stress, and reduced cognitive performance, with children, older adults, and people with pre-existing health conditions being particularly vulnerable. In schools and workplaces, excessive indoor temperatures can affect learning, productivity, and overall well-being. Housing, shelters, anganwadis and workplaces are unable to protect people from heat. Cool roofs provide a simple, cost-effective, and scalable solution. By using high-albedo, reflective roof coatings and materials, roof surface temperatures can be significantly reduced, leading to indoor temperature reductions. This improves thermal comfort, reduces heat-related health risks, lowers energy consumption for cooling, and helps reduce peak electricity demand, contributing to both climate resilience and energy security. Cool roofs should be promoted alongside other measures such as shading, ventilation, insulation, orientation, operable windows and nature based solutions and TNGCC is working with UNEP to implement such measures alongside cool roofs.

Objective

The objective of this SOP is to provide clear, standardised guidance on implementing cool roof paint coatings across buildings with RCC-finished or terracotta-finished roof surfaces. This includes

- Ensuring correct roof surface preparation before application.
- Ensuring proper application of primer and coating layers in accordance with specified procedures.
- Ensuring adherence to quality standards during application.
- Ensuring appropriate post-application inspection, documentation, and maintenance practices.

Scope

This SOP applies to a wide range of building typologies across Tamil Nadu, including institutional, residential, commercial, and public infrastructure buildings with RCC-finished or terracotta-finished roof surfaces. It serves as a standard reference for field teams, contractors, technical experts, and implementing agencies involved in planning, execution, monitoring, and documentation of cool roof coating interventions.

It outlines the end-to-end process, including surface preparation, application, inspection, and maintenance. Feasibility assessment, waterproofing, and major repairs are excluded and will be handled by PWD or relevant authorities. Indicative technical specifications are included to support procurement and ensure quality standards across sites.

PROJECT FEASIBILITY ASSESSMENT

As a first step, the roof surface should be inspected to assess its suitability for cool roof treatment and to identify any conditions that may impact coating performance.

1. The inspection should include identification of:

Surface finish defects

including cracks, broken tiles, loose or detached finishes, and deterioration of the top layer

Damage to the roof slab or underlying substrate

including caving, missing or deteriorated waterproofing layers

Seepage points and signs of moisture ingress.

Structural defects affecting the stability or integrity of the roof

Service infrastructure on the roof including overhead tanks, solar PV systems, solar heaters, antennae, and other installations

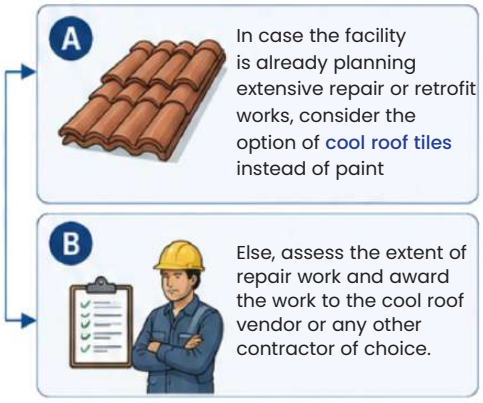
Accumulated debris vegetation growth, dust, and other contaminants that interfere with adhesion

2. Roof Review

Before commencing the application, the roof should be reviewed to confirm its suitability for the coating system. Where required, inputs from a qualified structural engineer may be obtained prior to proceeding with the application.

3. If the roof surface shows significant surface or structural damage, repairs must be undertaken first:

If the roof needs deep repair, such as structural damage or waterproofing failure in multiple locations, the implementing agency must either



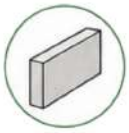
4. Once the decision to proceed with cool roof paint is made, the subsequent steps should be undertaken in accordance with the procedure outlined in this document

PROCUREMENT AND MEASUREMENT PROTOCOL

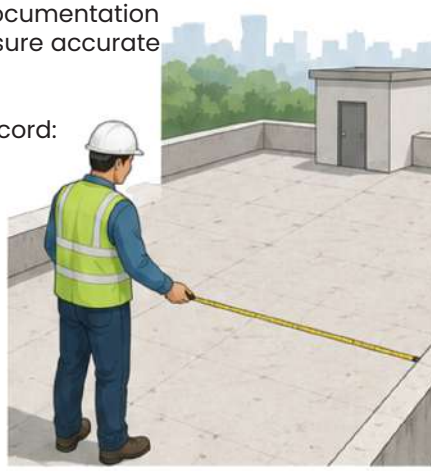
A detailed site measurement and documentation exercise should be conducted to ensure accurate material estimation and planning.

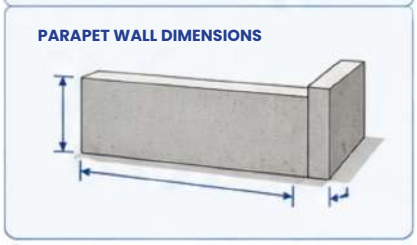
The implementing agency should record:

Total roof area for coating

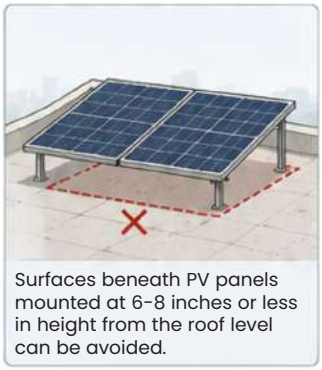


Parapet wall dimensions



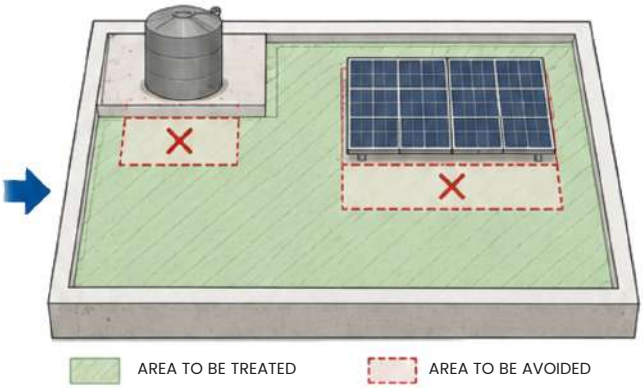


Decide and measure the area of the roof to be treated. Decide if the area beneath overhead water tanks and solar rooftop photo-voltaic (PV) systems is to be avoided.



Surfaces beneath PV panels mounted at 6-8 inches or less in height from the roof level can be avoided.

Once the area has been determined, the materials will be procured based on the specifications given below.



MATERIALS

Cool roof reflective coating

Primary heat-reflective layer applied to reduce solar heat gain.

Roof primer

Applied to enhance adhesion between the substrate and coating system.

Crack filler/ Repair mortar

Used for repairing cracks, holes, and surface irregularities.

Cleaning water and preparation materials

Required for surface cleaning and preparation.

Protective sealer / top coat (where applicable)

Applied to improve durability and surface performance.

Parameter	Minimum Recommended Value
Solar Reflectance (SR)	≥ 0.60
Thermal Emittance (TE)	≥ 0.90
Solar Reflectance Index (SRI)	≥ 95
UV Resistance	High
Fungal/Algal Resistance	Preferably should comply with ASTM D3273 or equivalent
VOC Content	Low VOC preferred
Adhesion Strength	Good adhesion to concrete, metal, or existing roof surface

NOTE: The Solar Reflectance and Thermal Emittance values have been adopted from the UNEP PCS Guidelines.

TOOLS AND EQUIPMENT

Rollers, brushes, and spray equipment (as applicable)

Scrapers and wire brushes for surface cleaning

Mixing tools for material preparation

Cleaning equipment (water hoses, jet systems, etc.)

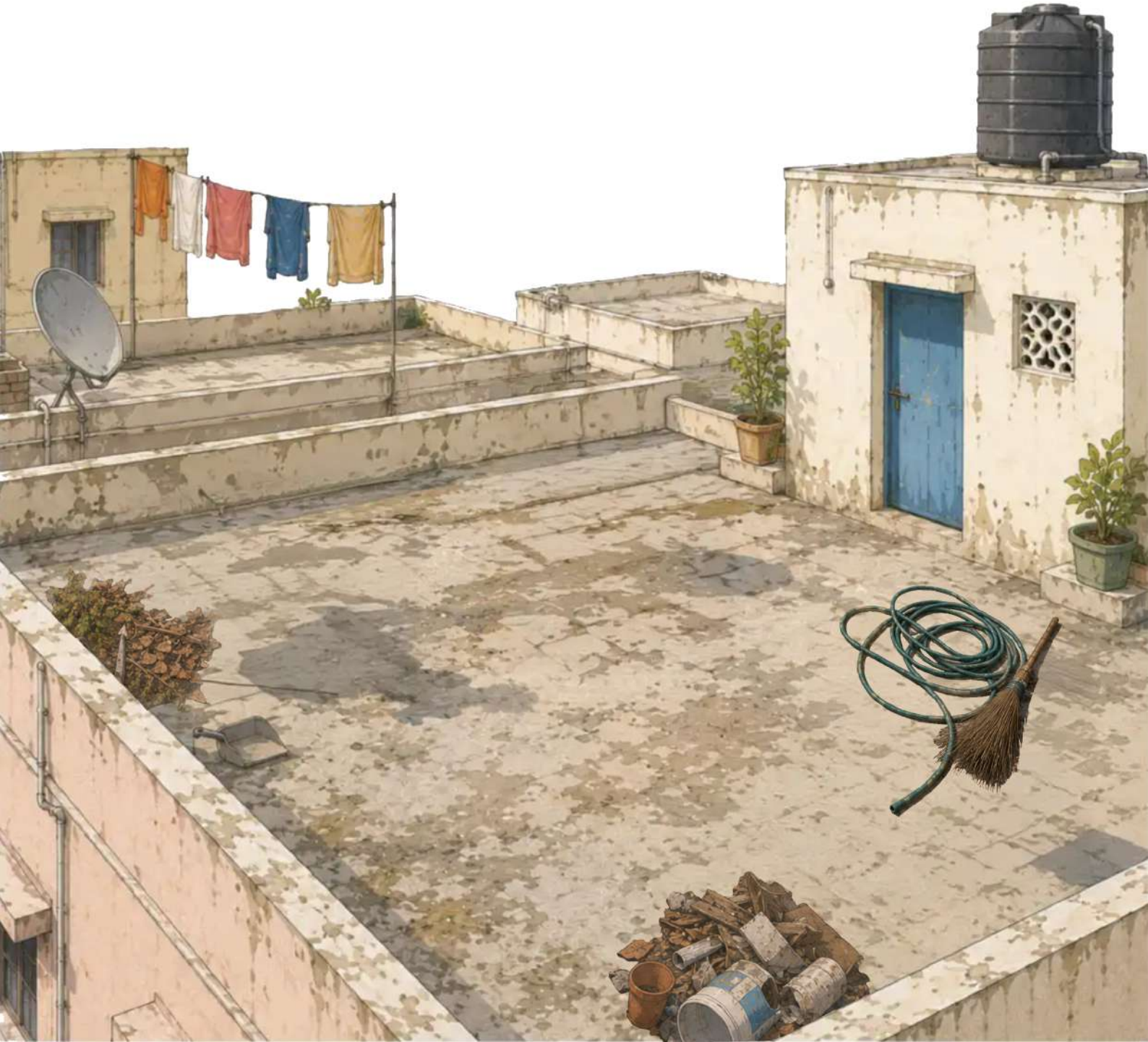
Personal protective equipment (PPE), including gloves, masks, and safety footwear

NOTE: Supply and application of three coats heat reflective & insulative coating having minimum Solar Reflective Index (SRI) 78 or above, tested as per ASTM E408-71 (RA 1996) OR ASTM E 1980 (with solar reflectance & thermal emittance tested as per ASTM C 1549 and ASTM C 1371 respectively), should have excellent resistance to transmission of ponded water, with water absorption < 1% as per IS:101 (p7/Sec1) and should also be resistant to ammonia solution, sodium nitrate, sodium hydroxide along with water & soap solution as per IS 101:(p7/Sec3) 1990. Laminate it with a protective coating, which should be a nano-modified composite cross-linking polymeric-based dust, water & oil repellent coating with a transparent finish on the existing painted surface, using a roller/spray/brush. Coating should be fast drying, anti - graffiti, scratch resistant, and should have self-cleaning & easy to clean property with excellent weather stability.

PRE-COATING APPLICATION PREPARATION (PHASE I)

If the roof surface has active seepage, waterlogging, or substantial vegetation growth, deep cleaning must be undertaken first as follows:

NOTE: The application agency should be responsible for removing debris and conducting first-level cleaning of the roof surface before surface preparation activities begin, as per standard PWD procedures.

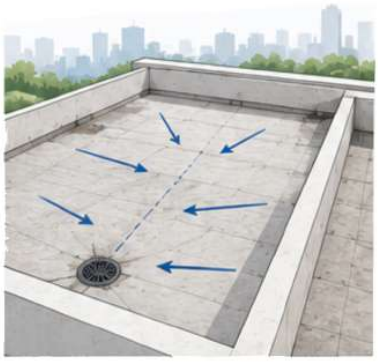


WATER LEAKAGE & LOGGING

Identify the source of leakage (e.g. overhead water tanks, water supply pipes, cooling towers, clogged rainwater drains, etc.) and either repair to prevent further leakage or if unrepairable, to remove the leakage source.

Ensure that the slope for the flow of rainwater is intact and has provision for heavy rainfall.

Clean all debris around rainwater drain points and repair any pipes if required



Design adequate for heavy rainfall. The painting works must only commence once the wet surfaces are dry.

SUBSTANTIAL VEGETATION & SCRAP (METAL, FURNITURE, ETC.)

Deploy internal resources or award the work to a vendor, of removing all vegetation from root onwards, check roof condition beneath and follow point from section 4 - 3.a before commencing cool roof painting.

MANAGING SERVICE INFRASTRUCTURE ON THE ROOF

If any service infrastructure (solar rooftop photo-voltaic (PV) systems, solar heaters, antennae, and other installations) is likely to obstruct the application of paint, plan and undertake (with own resources or through a cool roof vendor) relocation, removal and stacking of the infrastructure.

Ensure that electricity and water supply, plus secure equipment storage facilities is available to the vendor during the application phase.

EVALUATE CONSTRAINTS ASSOCIATED WITH FIXED INSTALLATIONS

Where sufficient clearance is available, coating should be applied beneath installations.

Where clearance is limited, such areas should be clearly identified, excluded, and documented.

PRE-COATING APPLICATION PREPARATION (PHASE II)

Plan application only when rainfall is not expected within the next 24–48 hours and when roof surfaces are fully dry.

STEPS TO FOLLOW

Cleaning and preparation → Crack repair and levelling → Primer application → Reflective coating coats → Final protective / sealer coat → Parapet wall coating → Final inspection & documentation

STEP 1: ROOF SURFACE PREPARATION

- Remove dust, dirt, debris, and vegetation from the roof surface
- Scrape off loose plaster, old paint, or deteriorated materials
- Clean the roof using a jet water wash or mechanical brushing, as appropriate
- Allow the roof to dry completely before proceeding

STEP 2: SURFACE CRACK REPAIR AND SURFACE LEVELLING

- Identify cracks, holes, and damaged areas
- Fill cracks and gaps using Polymer-modified cementitious crack filler or repair mortar
- Level uneven patches to create a stable and uniform base using cementitious repair mortar or polymer-modified levelling compounds, compatible with the coating
- Ensure repairs are dry and sound before the next stage.

STEP 3: PATCH TEST

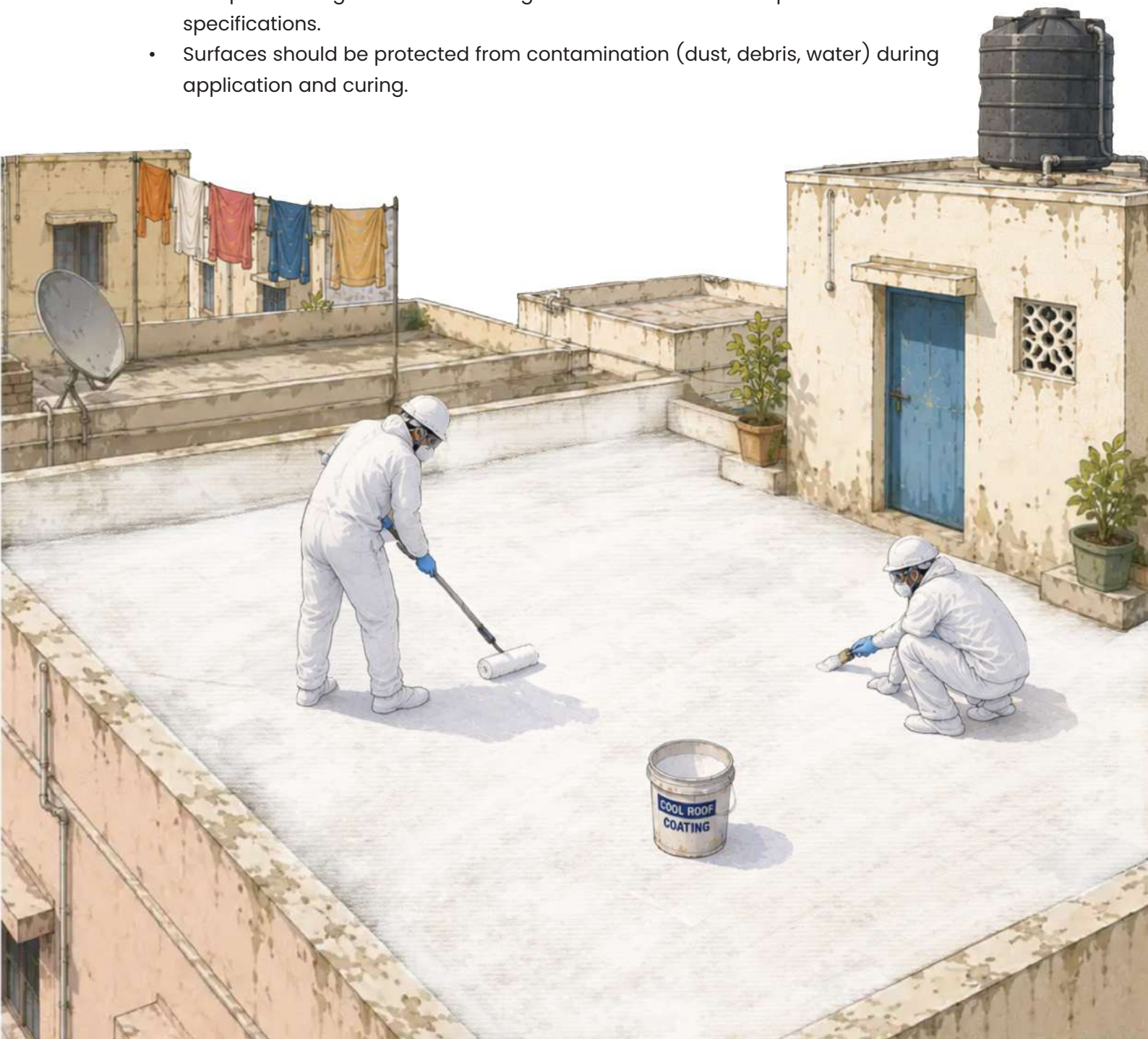
- A patch test should be done after completion of surface preparation and repairs, and before primer application.
- Select a small representative section of the prepared roof surface.
- Apply the coating system as per the manufacturer's guidance.

The patch test should be undertaken to verify adhesion of the coating material to the prepared substrate and confirm compatibility with the roof surface. Also assess drying time and coating behaviour under actual site conditions. The test area should be observed for a minimum of 24 hours. If peeling, blistering, poor adhesion, or any other defects are observed, corrective actions, including re-preparation of the surface, should be undertaken before proceeding further.

APPLICATION

Common environmental and weather conditions for the application:

- All stages of application, including surface preparation, crack repair, primer application, and coating, should be carried out under suitable environmental conditions to ensure proper adhesion, curing, and performance.
- Application should be undertaken only on clean, dry surfaces free from moisture, dampness, or water stagnation.
- Work should not be carried out during rainfall or when rainfall is expected within the next 24 hours.
- Extreme temperature conditions, including peak heat and direct sunlight exposure, should be avoided.
- Adequate curing time between stages should be ensured as per the manufacturer's specifications.
- Surfaces should be protected from contamination (dust, debris, water) during application and curing.



STEP 1: WATERPROOFING PRIMER APPLICATION

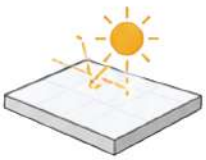
- Apply primer evenly across the prepared roof surface using rollers or brushes.
- Ensure uniform coverage and avoid excessive application or pooling.
- Allow the primer to cure for approximately six hours, or as per manufacturer recommendations and weather conditions.

STEP 2: APPLICATION OF FIRST COAT OF COOL ROOF COATING

- Apply the first coat using rollers or spray equipment, as suitable.
- Maintain uniform coating thickness and avoid uncoated patches.
- Allow the first coat to dry for approximately five hours before the next coat is applied.

STEP 3: APPLICATION OF SECOND COAT OF COOL ROOF COATING

- Apply the second coat after the first coat has dried adequately.
- Ensure uniform coverage across the entire roof surface to enhance thermal performance and durability.



STEP 4: APPLICATION OF FINAL SEALER / PROTECTIVE COAT

- Apply the final coat uniformly across the roof surface after adequate drying of the previous layer.
- Ensure even coverage, a uniform finish, and no missed patches or streaks.
- Allow the coating system to fully dry and cure before the roof is considered complete.

ALLOW TO FULLY DRY AND CURE

STEP 5: PARAPET WALL COATING

- Coat the first foot of the parapet wall around the roof perimeter using the same cool roof coating system.

STEP 6: FINAL INSPECTION AND QUALITY CHECK

- Verify that all roof areas are properly coated.
- Confirm uniform coating thickness and absence of visible defects or missed patches.
- Confirm completion of parapet wall treatment.
- Record photographic documentation before and after application.

QUALITY ASSURANCE

Quality assurance measures should be followed throughout the application process. Field teams should verify that the following conditions are met at each site:

CHECKPOINT	VERIFICATION REQUIREMENT	REFERENCE
Roof cleaning	The roof surface is free from debris, dust, vegetation, and loose materials	
Surface repair	Cracks, holes, and damaged areas have been repaired and levelled	
Patch test	The patch test has been completed & found satisfactory before full application	
Primer application	Primer coverage is uniform, and curing time has been observed.	
Coating layers	Each coat is evenly applied with no visible gaps, streaks, or missed areas	
Curing intervals	Recommended drying and curing times between coats are followed	
Parapet wall treatment	The first foot of the parapet wall has been coated.	
Documentation	Photographs and measurement records have been maintained for monitoring and reporting	

NOTE: Any missed areas, uneven coatings, or visible defects should be corrected immediately before final handover.

SAFETY CONSIDERATIONS

Restrict roof access during application. Ensure that occupants and personnel do not access the roof while work is in progress.

Require workers to use appropriate PPE, including gloves, masks, and safety footwear.

Avoid application during rainy conditions, strong winds, or unsafe weather.

Maintain safe storage and handling of materials, equipment, and tools on site.

Operation, Maintenance and Periodic Re-Coating Guidelines for Cool Roof Coatings

Conduct roof inspections at least once a year, ideally before summer, to check for dust buildup, algae/ fungal growth, cracks, and coating deterioration.

Clean the roof periodically using low-pressure water and a soft brush to remove dirt and debris; avoid abrasive cleaning methods and harsh chemicals.

Ensure proper drainage by clearing outlets and preventing water stagnation, as ponding can damage the coating over time.

Address localised damages such as peeling, blistering, cracks, or mechanical wear promptly to prevent further degradation and moisture ingress.

Avoid unnecessary foot traffic and use protective walk pads where frequent access is required.

Verify adhesion and reflectivity performance periodically, especially after extreme weather events.

Plan for full re-coating based on product life and exposure conditions, typically every 5–7 years, to restore optimal thermal performance.

Follow manufacturer guidelines for surface preparation and application during re-coating to ensure durability and effectiveness.

Maintain records of inspections, cleaning, repairs, and re-coating cycles to support timely maintenance and extend service life.

Roles & Responsibilities

Successful application of cool roof paint interventions requires coordination among multiple stakeholders involved in planning, execution, monitoring, and documentation.

Stakeholder	Key Responsibilities					
	Feasibility	Procurement	Application			Post Application
			Phase 1 Surface preparation	Phase 2 Surface preparation	Phase 3 Coating	
Environment, Climate Change and Forests Department (ECCFD)	Provide overall programme oversight and approvals; ensure adherence to guidelines; facilitate coordination among the implementing agencies.					
Building Administration / Other Implementation Agency			1. First cleaning of the roof, removing large debris, vegetation, scrap, etc., to allow painting. 2. Adjust or relocate any roof infrastructure (solar rooftop photo-voltaic, solar water heater, overhead tanks, etc.)	1. Facilitate access to building premises. 2. Facilitate access to a secure supply of water and electricity during the roof preparation phases. 3. Support safe implementation arrangements (no scaffolding, major and parallel electrical or structural repair). 4. Keep the site secure during execution. 5. No non-essential personnel are to have access. 6. Instructions to users not to tread on a wet surface. 7. Safe and secure storage facility for paint, cleaning and other equipment.		

Stakeholder	Key Responsibilities					
	Feasibility	Procurement	Application			Post Application
			Phase 1 Surface preparation	Phase 2 Surface preparation	Phase 3 Coating	
Building Administration / Other Implementation Agency				8. Instructions to users not to tread on a wet surface. 9. Safe and secure storage facility for paint, cleaning and other equipment. 10. Ensure uninterrupted functioning of any electronic monitoring equipment (sensors, etc.). 11. Constant power supply to equipment. 12. Provide secure locations for installations. 13. Instruct staff and users not to tamper with instruments.		
Contractors (Vendors)		Ensure availability of materials, tools, and manpower		Carry out roof preparation and coating application in accordance with SOP. Remove any remaining debris, removal and dry clean the roof, and then conduct patch tests before large-scale application.	Apply primer and coating layers as per specifications and curing requirements Ensure uniform application and coverage	Conduct final inspection and rectify defects

Annexure

Annexure A. Site Documentation Checklist

1. Record building name, location, and date of application.
2. Measure and record total roof area and parapet dimensions.
3. Document the roof type and existing surface condition.
4. Capture pre-application photographs.
5. Record details of repairs carried out before coating.
6. Document patch test location, date, and observations.
7. Capture photographs during primer and coating application.
8. Capture post-application photographs and final measured area treated.
9. Obtain sign-off from the application team and the site representative.

Annexure B. Indicative Inspection Checklist for Field Teams

Item	Yes / No	Remarks
Roof cleaned and dry before application		
Repairs completed before primer application		
Patch test conducted and accepted		
Primer applied uniformly		
First coat applied uniformly		
Second coat applied uniformly		
Final sealer coat completed		
Parapet wall treatment completed		
Photographic records completed		
Final inspection completed		

Annexure C. Indicative Resource and Implementation Planning

Parameter	Unit	RCC Flat Roof	Terracotta finished Roof
Area to be painted	sq.m		
Crack filler	kg		
Primer quantity	litres		
Cool roof coating quantity	litres		
Final Sealer Coat	litres		
Number of workers	no.		
Supervisor / skilled applicator	no.		
Surface preparation time	days		
Application time	days		
Total duration (including curing gaps)	days		
Water requirement	litres		

Notes

Tamil Nadu Green Climate Company (TNGCC), No. 327, 10th Floor, CMRL Building,
Anna Salai, Nandanam, Chennai - 600035, Tamil Nadu