This is a guidance document with sample specification language intended to be inserted into project specifications on this subject as appropriate to the agency's environmental goals. Certain provisions, where indicated, are required for U.S. federal agency projects. Sample specification language is numbered to clearly distinguish it from advisory or discussion material. Each sample is preceded by identification of the typical location in a specification section where it would appear using the SectionFormat™ of the Construction Specifications Institute; the six digit section number cited is per CSI Masterformat™ 2004 and the five digit section number cited parenthetically is per CSI Masterformat™ 1995.

SECTION 07 50 00 (SECTION 07500) – MEMBRANE ROOFING

SPECIFIER NOTE:

resource management: Membrane manufacturers are developing products fabricated from post-consumer materials. Refer to Section 07 30 00 (07300) – Steep Slope Roofing for additional information.

toxicity/IEQ: The cold adhesives used in adhesive application of roofing membranes are generally volatile chemicals. Roofing adhesive that is water-based and/or low-VOC is available. Refer to Section 06 60 00 (06600) – Plastic Fabrications for information regarding plastics.

performance: Provide light colored roof surfaces to improve albedo.
Membrane roofing is difficult to recycle because of the variety of materials involved and because those materials are generally adhered to each other. While reuse and recycling of membrane roofing is not typical, it is possible. Mechanically fastened membranes are easier to disassemble in the future; facilitating recycling of membrane and of substrate. Installation of a layer of sheathing between roofing insulation and roofing membrane, may allow for membrane removal without damage to insulation.
FEMP maintains recommendations for roofing materials at http://www1.eere.energy.gov/femp/technologies/eep_roof_products.html

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
1. **[EPDM] [PVC] [TPO] [xxxx]** roofing system.
2. Roof Deck Coating.

B. Related Sections:
1. 07 20 00 (07200) – Thermal Protection: Board insulation.
2. 48 14 00 (13600) – Solar Energy Electrical Power Generation: Photovoltaic roofing.

1.2 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

SPECIFIER NOTE:
Green building rating systems often include credit for materials of recycled content. USGBC-LEED™ v3, for example, includes credit for materials with recycled content, calculated on the basis of pre-consumer and post-consumer percentage content, and it includes credit for use of salvaged/recovered materials.
Green Globes US also provides points for reused building materials and components and for building materials with recycled content.

1. Recycled Content:

a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
c. If recycled content product is part of an assembly, indicate the percentage of recycled content product in the assembly by weight.
d. If recycled content product is part of an assembly, indicate relative dollar value of recycled content product to total dollar value of assembly.

SPECIFIER NOTE:
Specifying local materials may help minimize transportation impacts; however it may not have a significant impact on reducing the overall embodied energy of a building material because of efficiencies of scale in some modes of transportation.
Green building rating systems frequently include credit for local materials. Transportation impacts include: fossil fuel consumption, air pollution, and labor.
USGBC-LEED™ v3 includes credits for materials extracted/harvested and manufactured within a 500 mile radius from the project site. Green Globes US also provides points for materials that are locally manufactured.

2. Local/Regional Materials:
   a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
   b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
   d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

SPECIFIER NOTE:
Green building rating systems may include credit for low emitting materials. USGBC-LEED™ v3, for example, includes credits for low-emitting materials, including: adhesives and sealants, paints and coatings, carpets, and composite wood and agrifiber products. Under LEED™ v3, adhesives and sealants are to comply with California's South Coast Air Quality Management District (SCAQMD) #1168; aerosol adhesives are to comply with Green Seal GS-36; interior architectural paints are to comply with Green Seal GS-11; anti-corrosive paints are to comply with Green Seal GS-03 (note – Green Seal has withdrawn GS-03; as of November 2008, anti-corrosive paints are included in a revised GS-11); clear wood finishes are to comply with SCAQMD #1113; carpet with the Carpet and Rug Institute (CRI) Green Label Plus; carpet cushion with CRI Green Label program; and, composite wood and agrifiber products are to contain no added urea-formaldehyde.
As per USGBC published Credit Interpretations, the credits for low-emitting materials are directed towards interior, site-installed (i.e. not prefabricated) products. Verify project requirements for low VOC roofing products.
Both the Adhesive and Sealant Council (ASC) and the SCAQMD have indicated that low VOC adhesives may have performance difficulties in extreme temperature and humidity conditions.
Green Seal, an independent, non-profit organization, certifies low-emitting products using internationally recognized methods and procedures. Green Seal certification meets the criteria of ISO 14020 and 14024, the environmental standards for ecolabeling set by the International Organization for Standardization (ISO); the U.S. Environmental Protection Agency's criteria for third-party certifiers of environmentally preferable products; and the criteria for bona fide ecolabeling bodies of the Global Ecolabeling Network.

3. VOC data:
   a. Adhesives:

1) Submit manufacturer's product data for adhesives. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.

SPECIFIER NOTE:
On hot summer days, urban air can be 2-10 degrees Fahrenheit hotter than the surrounding rural areas. Not to be confused with global warming, scientists call this phenomenon the "urban heat island effect." Heat islands form as vegetation is replaced by asphalt, concrete and other structures. These surfaces absorb – rather than reflect – the sun's heat, causing surface temperatures and overall ambient temperatures to rise. The displacement of trees and shrubs eliminates the natural cooling effects of shading and evapotranspiration (a natural cooling process in which water transpires from a leaf's surface and evaporates into the atmosphere, reducing ambient temperature). Refer to the EPA's Heat Island Reduction Initiative for additional information, http://www.epa.gov/heatisland/index.htm

USGBC-LEED™ v3 includes credit for reducing the heat island effect. To qualify, vegetated surfaces and/or high-albedo materials are necessary. USGBC identifies high-albedo materials for non-roof areas as materials with a Solar Reflectance Index (SRI) of at least 29. The SRI is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980-01. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.
For roofing, USGBC provides credit for low-slope roofs with a minimum SRI of 78 and for steep-slope roofs with a minimum SRI of 29.

Green Globes – US also requires measures to reduce heat build-up on the roof (i.e. either high-albedo roofing materials (reflectance of at least 0.65 and emissivity of at least 0.9), OR a green roof, OR a combination of both high-albedo materials and green roof).

To qualify for an Energy Star label:
- Low Slope roofs must have an initial solar reflectance of >= 0.65. After 3 years, the solar reflectance must be >= 0.50.
- Steep Slope roofs must have an initial solar reflectance of >= 0.25. After 3 years, the solar reflectance must be >= 0.15.

4. Albedo data: Provide information identifying the **[SRI] [solar reflectance]** of the following products provided under work of this Section:
   a. Roofing.
5. Emissivity data: Provide information identifying the emmissivity of the following products provided under work of this Section:
   a. Roofing.
6. Energy Efficiency:
   a. Submit documentation for Energy Star qualifications for products provided under work of this Section.

SPECIFIER NOTE:
The Food, Conservation, and Energy Act of 2008 (also known as the 2008 U.S. Farm Bill) largely continues programs of the Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) http://www.usda.gov/farmbill/ Section 9002 requires each Federal Agency to develop a procurement program which will assure that items composed of biobased products will be purchased to the maximum extent practicable and which is consistent with applicable provisions of Federal procurement law. USDA designates biobased products for preferred Federal procurement and recommends biobased content levels for each designated product.
USGBC-LEED™ v3 includes credits for use of rapidly renewable materials, which USGBC describes as plants harvested within a ten-year cycle.

Green Globes – US, provides credit for integration of materials from renewable sources that have been selected based on life-cycle assessment.

7. Biobased materials:
   a. Indicate type of biobased material in product.
   b. Indicate the percentage of biobased content per unit of product.
   c. Indicate relative dollar value of biobased content product to total dollar value of product included in project.

B. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

C. Operating And Maintenance Manuals Submittals:

SPECIFIER NOTE:
The marking system indicated below is intended to provide assistance in identification of products for making subsequent decisions as to handling, recycling, or disposal.

Society of Plastic Inc. resin codes are easily recognized by the consumer. These are the numerical designations within chasing arrows. At the present time there is not a separate resin code for PLA (bio-resins). PLA (bio-resins) are classified as #7 (Other). Nor are there specific indications for additives or blends. The Society of Plastics resin code symbols are common for plastic packaging materials; for example:

ASTM D1972 standard specifies a resin code that provides substantially more information regarding the plastic resin, including blends and additives. ASTM D1972 labeling protocols are not common for packaging materials; however, they are recognized and utilized in the construction industry and other industry sectors. Many construction products are labeled according to ASTM D1972. Such detailed information is anticipated to be necessary data for future deconstruction (and recycling) efforts. Therefore, plastic construction products and plastic components of assemblies should be labeled in accordance with ASTM D1972. Example for a polypropylene containing 30 mass percentage of mineral powder use:

>PP-MD30<

   a. Verify that plastic products, including plastic components in assemblies, to be incorporated into the Project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in Operation and Maintenance Manual.

      1) Products made from compositions containing a single filler, reinforcing, or other modifying material in a concentration of more than one percent by mass shall be marked with the abbreviated term for the polymer, followed by a dash, then the abbreviated term or symbol for the additive, with its percentage by mass, arranged as shown in the example and set off with brackets. For example, a polypropylene containing 30 mass percentage of mineral powder use would be labeled: >PP-MD30<

1.3 QUALITY ASSURANCE

A. Albedo:

SPECIFIER NOTE:
The EPA Energy Star program recommends Solar Reflectance for low sloped roofs as indicated below. Additional considerations for the procurement official include: Geographic location of building; the amount of insulation; and roof surface to building volume ratio. Refer to http://www.energystar.gov/index.cfm?c=roof_prods.pr_proc_roof_products

1. Low sloped: Initial Solar Reflectance greater than or equal to 0.65. Maintenance of Solar Reflectance greater than or equal to 0.50 three years after installation under normal conditions.

B. Emissivity:
1. Provide minimum 0.9 emissivity as tested in accordance with ASTM E408.

C. Energy Efficiency:

SPECIFIER NOTE:
Roof systems that meet or exceed solar reflectance, without compromising product quality and performance, qualify for the Energy Star label. Manufacturers voluntarily sign an agreement with Energy Star called a Partnership Agreement (PA) allowing them to place the Energy Star label on the packaging of qualifying roof products. An Energy Star qualified roof product lowers roof surface temperature by up to 100°F, thereby decreasing the amount of heat transferred into a building's interior. Energy Star roof specifications are not restricted to any particular type of roof product. However, Energy Star expects that, at least initially, metal, single-ply membrane, and roof coating products will be most widely represented. For additional information, refer to http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

1. Provide Energy Star labeled roofing systems

SPECIFIER NOTE:
NSF-ISR has a draft standard for multi-attribute evaluation of environmental preferability:
NSF 347 Sustainability Assessment Standard for Single Ply Roofing Membranes
As used in this standard, "Single Ply Roofing" includes, but is not limited to, EPDM (Ethylene Propylene Diene Monomer), KEE (Ketone Ethylene Ester), PVC (Polyvinyl Chloride), and TPO (Thermoplastic Polyolefin) products.
The draft standard compares and assesses sustainable product characteristics of single ply roofing. Assessment is implemented through a point system that addresses: materials, water efficiency, energy conservation, air quality, and social issues. Four levels of achievement or compliance are attainable to reflect increasing movement toward sustainability: Conformant, Silver, Gold, and Platinum.
http://www.nsf.org/business/sustainability/standards_inprocess.asp?program=Sustainability
Edit below to suit project and to reflect latest published standard.

D. Provide wallcovering compliant with NSF 347 **[Conformant] [Silver] [Gold] [Platinum]** level.

PART 2 - PRODUCTS

SPECIFIER NOTE:
EO 13423 includes requirements for Federal Agencies to use “sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products”

Specifically, under the Sustainable Building requirements per Guiding Principle #5 Reduce Environmental Impact of Materials, EO13423 directs Federal agencies to “use products meeting or exceeding EPA's recycled content recommendations” for EPA-designated products and for other products to “use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project.”

EO 13423 includes requirements for Federal Agencies to "… improve energy efficiency and reduce greenhouse gas emissions … by (i) 3 percent annually through the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of … year 2003"

Specifically, under the Sustainable Building requirements per Guiding Principle #2 Optimize Energy Performance, EO 13423 directs Federal agencies to "design to earn the Energy Star targets for new construction and major renovation" and, for "new construction, reduce the energy cost budget by 30 percent compared to the baseline building performance rating per the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., (ASHRAE) and the Illuminating Engineering Society of North America (IESNA) Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential. For major renovations, reduce the energy cost budget by 20 percent below pre-renovations 2003 baseline."

Executive Order 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*; was signed on October 5, 2009. http://www.ofee.gov/execorders.asp It expands upon the environmental performance requirements of EO 13423.
http://www1.eere.energy.gov/femp/regulations/printable_versions/eo13423.html

EO 13514 sets numerous federal requirements in several areas, including sustainable buildings and communities. Federal agencies must implement high performance sustainable federal building design, construction, operation and management, maintenance, and deconstruction, including:

- Ensuring all new Federal buildings, entering the design phase in 2020 or later, are designed to achieve zero net energy by 2030.
- Ensuring all new construction, major renovations, or repair or alteration of Federal buildings comply with the Guiding Principles of Federal Leadership in High Performance and Sustainable Buildings http://www1.eere.energy.gov/femp/pdfs/mouhighperfsustainfedfacs.pdf
- Ensuring at least 15% of existing agency buildings and leases (above 5,000 gross square feet) meet the Guiding Principles by fiscal year 2015 and that the agency makes annual progress towards 100% compliance across its building inventory.

2.1 MATERIALS

A. Membrane:

SPECIFIER NOTE:
Green building rating systems often include credit for materials of recycled content and may distinguish allowable credit for post-consumer and post-industrial (or pre-consumer) recycled content. USGBC-LEED™ v3, for example, factors 100 percent of post-consumer recycled content but only 50 percent of pre-consumer (post-industrial) recycled content into calculations for its recycled content materials credit. LEED v3 grants one credit to a project for using materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10 percent of the total value of the materials in the project; 10% (post-consumer + 1/2 post-industrial). It grants an additional point for 20% (post-consumer + 1/2 post-industrial).
Green Globes US also provides points for reused building materials and components and for building materials with recycled content.
Recycled content is typically determined by calculating the weight of the recycled material divided by the total weight of the product and expressed as a percentage by weight. (The recycled content "value" of a product as assessed under LEED is determined by multiplying the recycled content percentage and the cost of the product.)
Verify with manufacturer for product availability and recycled content.

1. Recycled Content: Minimum **[5] [10] [xxxx]** percent post-consumer recycled content, or minimum **[20] [40] [xxxx]** percent pre-consumer recycled content at contractor's option.

B. Roof Deck Coatings:

SPECIFIER NOTE:
For current designations under the Federal Biobased Products Preferred Procurement Program (FB4P), refer to www.biobased.oce.usda.gov. As of January 4, 2010, the Federal Register includes designations for approximately 60 product types. The requirements for purchasing biobased items apply to those items directly purchased by the federal agency. Under a construction contract, the contractor's use of hydraulic fluid in its bulldozers and backhoes is incidental to the purpose of its contract, so the contractor is not required to use biobased hydraulic fluids. The Office of the Federal Environmental Executive (OFEE) recommends that agencies encourage the use of these items, however.
Currently designated items that affect construction include:

- Roof Coatings
- Water Tank Coatings
- Adhesive and Mastic Removers
- Composite Panels
- Fertilizers
- Plastic Insulating Foam
- Carpet and Upholstery Cleaners
- Carpets
- Dust Suppressants
- Packaging Films
- Glass Cleaners
- Hydraulic Fluids – Stationary Equipment
- Wood and Concrete Sealers
- Cleaners

The USDA currently has identified about 150 items for which it is collecting test data needed for the additional designations of items that will extend preferred procurement status to include all qualifying biobased products.

1. Biobased Content: .
   a. Roof Coatings: Coatings formulated for use in commercial roof deck systems to provide a single-coat monolith coating system. Provide minimum 20% biobased content.

2.2 ACCESSORIES

A. Adhesive:
   1. Toxicity/IEQ: Low VOC.

B. Fasteners:
   1. Recycled Content: **[Fabricated from 100 percent re-melted steel].**

PART 3 - EXECUTION

3.X SITE ENVIRONMENTAL PROCEDURES

A. Waste Management: As specified in Section 01 74 19 (01351) – Construction Waste Management and as follows:
   1. Coordinate with manufacturer for **[take-back program].** Set aside scrap to be returned to manufacturer for recycling into new product.

END OF SECTION