

## 5. Ways to Reduce Copper Releases

Using other building materials is one obvious way to avoid having any copper releases in the first place. A number of manufacturers offer coated steel roofs, gutters, and downspouts with green colors that look like mature copper. Coated steel is a much newer and less expensive construction material that probably has a practical service life approaching that of copper.

A small metals treatment system may also be feasible as a way of removing copper from runoff before it is released into the environment.

- A combination metallic and ion exchange unit, such as is commonly used in photo shops and dental offices, will readily capture half or more of the copper from the example home mentioned before.
- One such unit costs an estimated \$2,500, with much of that amount being needed for excavation and placement of piping and an underground cistern to accumulate rainfall.
- Maintenance of the system involves cleaning filters annually, and replacing the exchange media every 5 years.
- This approach is expected to have a total cost about \$2,200 per kg (\$1,000 per lb) of copper that is diverted from the environment.

Several alternative schemes were considered, but rejected as unworkable.

- Filtration of the rainwater will not work because most of the copper washed off of a roof is in a dissolved form.
- Electrically active cathodic protection schemes are often used to impress a current between buried pipes and soil to counter the migration of metal ions. Such a technique would not work for roofs because there is no effective way of completing a circuit into the air.
- Sacrificial coatings, such as lead or zinc, could be applied over the entire roof (i.e., between the copper and the air). However, the zinc coating obviously looks much different from bare copper.

Exhibit 15 lists alternative best management practices ("BMPs") that, depending upon site conditions, may effectively reduce the amount of copper released into the environment from building roofs, gutters, and downspouts.

**Exhibit 15**  
**Alternative BMPs for Decreasing Copper Releases**

<u>BMP</u>	<u>Impact on Copper Release</u>	<u>Comments</u>
<b><u>Copper Roof</u></b>		
Use coated steel roof instead	- 100%	Costs less; appearance similar to but not exactly same as copper patina; may have somewhat shorter life
Use Pre-Patinated Copper Materials	- 50%	Costs more; patina is fragile
Clear-Coat Copper Surface	-75% or more	Unproven technique, although used to some extent with field-applied patinas
Treat all rainfall	- 75%	- Metallic Exchange - Ion Exchange - Both
Treat 1st hour of rainfall	- 50%	- Metallic Exchange (Smaller pump) - Ion Exchange - Both
Route runoff to planted area	Unknown	The ability of planted areas to permanently capture copper from runoff over time is not known.
<b><u>Algae-Resist Shingle Roof</u></b>		
<b><u>Composition Shingle Roof</u></b>		
<b><u>Copper Gutter &amp; Downspout</u></b>		
Use coated steel features instead	- 100%	Costs less; appearance similar to but not exactly same as copper patina; may have somewhat shorter life
Plastic Insert in Gutter & Downspout	Unk.	Not yet commercially available
Use Pre-Patinated Copper Materials	- 50%	Costs more; patina is fragile
Avoid Use of Field-Applied Patina Chemicals	Unknown	Field applied patinas are fragile and may fail, thereby releasing copper
Treat all rainfall	- 75%	- Metallic Exchange - Ion Exchange - Both
Treat 1st hour of rainfall	- 50%	- Metallic Exchange (Smaller pump) - Ion Exchange - Both
Route runoff to planted area	Unknown	The ability of planted areas to permanently capture copper from runoff over time is not known.

Exhibit 16 summarizes the costs associated with alternative BMPs for reducing the copper load in runoff from a 928 sqm (10,000 sqft) office or school building with copper gutters, downspout, and roof. The metals removal treatment unit is a pump-through device that requires a buried cistern for collecting runoff.

**Exhibit 16**  
**Costs of Alternative BMPs for Decreasing Copper Releases - 10,000 sqft Building**

BMP	Cost	Description	Copper Reduction (lbs/yr)
Change to pre-patinated copper (possibly with clear-coat)	\$12,000	10,000 sqft @ \$1.00 per sqft extra cost + 20% extra spoilage	- 1.1 (50%)
Change to coated steel roof	(\$15,000)	10,000 sqft @ \$1.50 per sqft savings	-2.2 (100%)
Install metals removal treatment *	\$10,500	Combined metallic / ion exchange; 10 l/min pump	-1.6 (75%)
Install metals removal treatment sufficient to handle small storms*	\$10,250	Combined metallic / ion exchange; 5 l/min pump	-1.1 (50%)

\* Refer to Appendix , Page A-6 for details of these estimated costs.



Photo: School With Coated Steel Roof

Exhibit 17 summarizes the costs associated with alternative BMPs for reducing the copper load in runoff from a 232 sqm (2,500 sqft) residence with copper gutters, downspout, and roof. The metals removal treatment system uses gravity-flow and does not require a buried cistern or pump.

**Exhibit 17**  
**Costs of Alternative BMPs for Decreasing Copper Releases - 2,500 Sqft Residence**

BMP	Cost	Description	Copper Reduction (lbs/yr)
Change to pre-patinated copper (possibly with clear-coat finish)	\$3,000	2,500 sqft @ \$1.00 per sqft extra cost + 20% extra spoilage	-0.27 (50%)
Change to coated steel roof	(\$3,750)	2,500 sqft @ \$1.50 per sqft savings	-0.54 (100%)
Install metals removal treatment*	\$1,200	Four gravity flow metallic exchange units	-0.32 (60%)

\* Refer to Appendix, Page A-8 for details of these estimated costs.