

Arsenal® PowerLine™ Herbicide

For Broad-Spectrum Vegetation Management



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Professional
Vegetation
Management



Always read and follow label directions.

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ARSENAL[®]
POWERLine[™]
herbicide

Arsenal[®] PowerLine[™]
Herbicide With
Transport Technology[™]
For Broad-Spectrum
Vegetation Management

Professional
Vegetation
Management

 **BASF**

The Chemical Company

Arsenal® PowerLine™ Herbicide

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Vegetation management strategies and solutions continue to evolve, giving vegetation management professionals more effective tools that promote the development and restoration of native habitat while addressing undesirable weed species.

Arsenal® PowerLine™ herbicide with Transport Technology™ is a low-volume herbicide providing effective, long-term brush and broadleaf weed control. Its patented chemistry offers greater uptake and more effective translocation of the active ingredient than other herbicides on the market.

Arsenal PowerLine is ideal for low-profile application methods such as low-volume foliar backpack spraying. It works equally well in aerial and low-volume ground applications when a broader spectrum of nonselective control is desired.

Arsenal PowerLine is well-suited for tank mixes and has been shown to improve the overall herbicide performance of tank-mix combinations. Combined with other herbicides or alone, **Arsenal PowerLine** offers broad-spectrum action, with residual soil activity – all designed to provide better and more consistent control of more species, all season long.

This technical bulletin is designed to help vegetation management professionals learn more about the benefits and correct use of **Arsenal PowerLine** on utility, highway, railroad and industrial sites. It answers common questions about how **Arsenal PowerLine** works and what it can do. As always, users must read the product label and material safety data sheet (MSDS) before making applications.

History and Development

THE DISCOVERY OF IMIDAZOLINONE HERBICIDES

In 1980, it was first shown that members of the imidazolinone herbicide family, including **Arsenal® herbicide**, could provide excellent control of a broad spectrum of grass, broadleaf, vine and brush species. In 1985, **Arsenal** received full federal registration for use in noncrop sites.

Arsenal® PowerLine™ herbicide has improved upon existing imazapyr herbicide family solutions by using patented Transport Technology that offers greater uptake and more effective translocation of the active ingredient than existing products on the market.

Arsenal PowerLine underwent comparative field tests to demonstrate the power of Transport Technology. Tests demonstrated it provides consistent control of numerous tough weed and brush species in a variety of environmental conditions.

GENERAL DESCRIPTION

Arsenal PowerLine is a broad-spectrum herbicide that controls a wide variety of annual and perennial broadleaf weeds and grasses, as well as troublesome brush species in rangeland, on utility installations, non-irrigation ditch banks, roadsides, industrial sites and other noncrop areas.

Arsenal PowerLine may be applied either preemergence or postemergence to weeds; however, postemergence application is preferred in most situations, particularly for control of perennial weeds and brush. For maximum control, **Arsenal PowerLine** should be applied when weeds are growing vigorously. The residual activity of **Arsenal PowerLine** provides control of most newly germinating weed species following a postemergence application.

Chemical Characteristics

MAMMALIAN AND ENVIRONMENTAL TOXICOLOGY

The potential for human toxicity of a herbicide is most commonly expressed as its LD₅₀. This is the amount of herbicide necessary to cause 50 percent mortality of a test population, usually white mice.

The LD₅₀ is expressed in milligrams of chemical per kilogram of body weight of the test animal. The higher the LD₅₀ number, the less toxic the compound.

The following table lists the oral and dermal LD₅₀ of many common chemicals, including **Arsenal PowerLine**.

RELATIVE TOXICITY OF COMMON CHEMICALS		
<i>Compound Toxicity</i>	<i>Oral LD₅₀</i>	<i>Dermal LD₅₀</i>
Kerosene	50	N/A
Payload®	>5000	>2000
Milestone™	>5000	>5000
Portfolio®	2084	>2000
Arsenal PowerLine	>2000	>5000
Roundup®	5400	>5000
Tordon®	8200	>4000

The toxicity of **Arsenal PowerLine** is illustrated by the battery of toxicology tests it has passed.

- **Arsenal PowerLine** is non-mutagenic, which means it has not been shown to cause gene mutations in test animals.
- **Arsenal PowerLine** is non-teratogenic, which means it has not been shown to cause birth defects in test animals.
- **Arsenal PowerLine** is a non-carcinogen, which means it has not been shown to cause cancer in test animals.

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A comparison of Arsenal PowerLine to Tordon®, Garlon® and Accord® SP, with respect to the standard measures of toxicity:

	Arsenal PowerLine	Tordon K	Garlon 4	Accord SP
Signal word	CAUTION	CAUTION	CAUTION	CAUTION
Oral toxicity LD ₅₀	>2000	>5000	1460	>5000
Dermal toxicity LD ₅₀	>5000	>5000	>5000	>5000
Inhalation	Non-toxic	Non-toxic	Non-toxic	Non-toxic
Eye irritation	None	Severe	Slight	Slight
Skin irritation	None	Mild	Mild	None
Skin sensitizer	Yes	No	Yes	No
Mutagenicity	None	None	None	None
Teratogenicity	None	None	None	None

Source: *Herbicide Handbook of the WSSA – Eighth Edition, 2002.*

Mode of Action

Mode of action involves the absorption of **Arsenal® PowerLine™ herbicide** across the plant leaf or root surface, translocation in the plant to the site of action and inhibition of the AHAS enzyme. This results in control of the target vegetation. Transport Technology offers greater foliar uptake and more effective translocation of the active ingredient than existing products on the market.

Arsenal PowerLine is considered to be practically non-toxic by ingestion in single doses. This is true in part because of its mode of action.

- **Arsenal PowerLine** affects AHAS (acetohydroxyacid synthase), an enzyme which is present only in plants.
- **Arsenal PowerLine** is considered practically non-toxic to all organisms that do not have the AHAS enzyme system.
- Humans and animals do not have the AHAS enzyme system.

SPEED OF ACTIVITY

Vegetation growth slows and stops within 24 hours of application for susceptible species. Visual symptomology first appears as plant yellowing (chlorosis), but may take days to weeks to develop, depending on type of vegetation and sensitivity.

Symptoms on vegetation generally appear more rapidly when the plant is actively growing. Death of the growing point can usually be seen four to 10 days after application on herbaceous species, but requires more time on woody species.

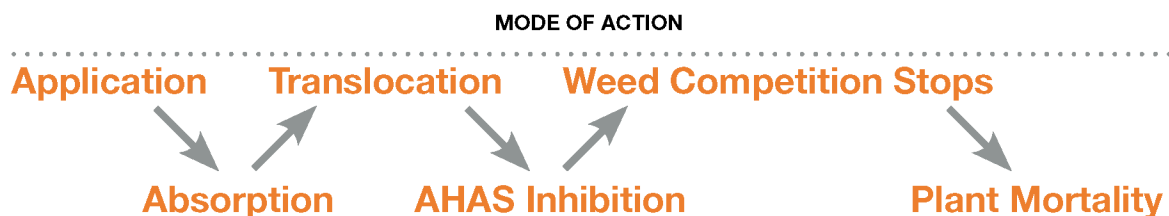
Industrial Uses of Arsenal PowerLine

USE AREAS FOR ARSENAL POWERLINE

Arsenal PowerLine is ideal for controlling a broad spectrum of weeds and brush in many situations where unwanted vegetation threatens the efficiency or effectiveness of operations, including:

- Utility installations, including transmission and distribution lines and substations
- Roadside sites, including along paved shoulders, under guardrails, and around signposts, delineators and bridge abutments
- Industrial sites such as tank farms, processing sites, fire walls, parking lots, fireplugs, fence lines, building perimeters and electrical switchyards
- In the railroad industry for line-of-track treatments and brush control
- Other noncrop sites where vegetation control is desired

In all situations, applicators have their choice of using **Arsenal PowerLine** in traditional hydraulic or aerial applications, or low-volume foliar backpack. Depending on the tank mix and method of application, **Arsenal PowerLine** can provide selective or total vegetation control.



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APPLICATION INFORMATION

Arsenal PowerLine is versatile enough to work well with a variety of application methods and equipment

1. **Low-volume foliar backpack.** This method enables applicators to selectively control vegetation using a minimum amount of spray. Backpack applications are low-profile and low-visibility. They are ideal for low-density vegetation under eight feet in height.

NOTE: To prepare a medium- to high-density vegetation site for backpack applications, it may be necessary to mow the area first and use backpack treatments in subsequent years.

2. **Low-volume hydraulic.** These applications enable you to use existing equipment while still gaining low-volume benefits. They work well in medium- to high-density vegetation and tackle the toughest brush.
3. **Aerial applications.** Aerial applications are highly effective. These applications are recommended only when minimal nontarget vegetation is present and precautions are taken to minimize or eliminate spray drift.
4. **Boom and boomless equipment.** Conventional boom-mounted or boomless nozzles work especially well in high-density, low-growing brush where wide coverage is desired.
5. **Special treatments.** **Arsenal PowerLine** may be used in either a concentrated or diluted solution for stump and cut-stem treatments. It also may be used for tree injection or frill or girdle treatments.

MIXING INSTRUCTIONS

Spray solutions should be mixed, stored and applied only in stainless steel, fiberglass, plastic and plastic-lined steel containers. Avoid mixing, storing or applying **Arsenal PowerLine** or spray solutions in unlined steel containers or spray tanks (unless stainless steel).

Following mixing, clean application equipment by thoroughly flushing with water.

RECOMMENDED APPLICATION RATES

Before applying, thoroughly mix a solution of **Arsenal PowerLine** in water using these suggested rates. Continuous agitation is recommended. Add drift control agents and/or spray indicators if necessary.

PERCENT SOLUTION MIXING GUIDE
FOR LOW-VOLUME APPLICATIONS

Amount of Spray Solution Being Prepared (Gallons)	Desired Concentration (fluid volume)				
	.5%	.75%	1%	1.5%	5%
	(Amount of Arsenal PowerLine to use)				
1	0.6 oz	0.9 oz	1.3 oz	1.9 oz	6.5 oz
3	1.9 oz	2.8 oz	3.8 oz	5.8 oz	1.2 pints
4	2.5 oz	3.8 oz	5.1 oz	7.7 oz	1.6 pints
5	3.2 oz	4.8 oz	6.5 oz	9.6 oz	2 pints
50	2 pints	3 pints	4 pints	6 pints	10 quarts
100	4 pints	6 pints	8 pints	6 quarts	5 gallons

2 tablespoons = 1 fluid ounce

**SPRAY SOLUTION MIXING GUIDE FOR THE
PREPARATION OF 100 GALLONS OF SPRAY MIXTURE FOR BROADCAST APPLICATIONS**

Spray Volume (Gallons of Spray Solution Applied Per Acre)	Desired Rate (per acre)		
	1 pt/acre	2 pts/acre	3 pts/acre
(Pints of Arsenal PowerLine to mix per 100 gallons of water)			
25 gallons	8 pints	12 pints	24 pints
30 gallons	6.7 pints	10 pints	20 pints
40 gallons	5 pints	7.5 pints	15 pints
50 gallons	4 pints	6 pints	12 pints
60 gallons	3.3 pints	5 pints	10 pints
75 gallons	2.7 pints	4 pints	8 pints
100 gallons	2 pints	3 pints	6 pints

8 pints = 1 gallon

TANK-MIX OPTIONS

Arsenal PowerLine may be tank-mixed with other registered herbicides to broaden the spectrum of weed control. Consult with all labels for compatibility and use recommendations. Follow the most restrictive label when tank-mixing. Observe all precautions and limitations.

For brush control, suggested tank mixes include:

APPLICATION RATES AND TANK MIXES

Target Vegetation	Rate of Arsenal PowerLine	Tank Mix
Mixed hardwoods without elm	1.0-1.5% by volume	Plus surfactant
Mixed hardwoods containing elm	0.5-1.0% by volume plus surfactant	Plus Accord at 2.0-3.0% by volume
Mixed hardwoods without elm	0.5-1.0% by volume plus surfactant	Plus Krenite® 2.0-5.0% by volume
Mixed hardwoods containing elm	0.5-1.0% by volume plus surfactant	Plus Escort™ (2 oz/A) or 2.3 grams/gallon

Bareground control also may be achieved by mixing **Arsenal PowerLine** with **Pendulum® AquaCap™** herbicide.

APPLICATION TIPS

Proper application is critical to ensure desirable results from any herbicide treatment. Refer to the following guidelines to improve application efficiencies for **Arsenal PowerLine**:

- As **Arsenal PowerLine** has both foliar and root activity, applications of **Arsenal PowerLine** around desirable vegetation or desirable trees must be at least 2x the distance from the drip line to avoid serious damage.
- Select proper nozzles to avoid spraying a fine mist.
- Avoid spraying under gusty or windy conditions and use drift-control agents when appropriate.
- Do not side-trim desirable vegetation.
- Do not apply directly to water, or to areas where surface water is present (other than as stated on the label), or to intertidal areas below the mean high-water mark.
- Maintain buffer zones when making aerial applications by fixed-wing aircraft.
- Beware of treating trees with root systems grafted to desirable vegetation as injury may occur to nontarget plants.

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VEGETATION CONTROLLED

Arsenal PowerLine will provide postemergence and residual control of the following target vegetation species. Residual control refers to control of newly germinating seedlings in both annuals and perennials. In general, annual weeds may be controlled by postemergence or preemergence applications of **Arsenal PowerLine**, whereas for established biennials and perennials, postemergence applications of **Arsenal PowerLine** are recommended. **Arsenal PowerLine** should be used in accordance with label recommendations.

Troublesome species controlled by **Arsenal PowerLine** include:

Brush and Tree Species

American Beach
Ash
Bald Cypress
Bigleaf Maple
Blackgum
Boxelder
Brazilian Peppertree
Cherry
Chinaberry
Chinese Tallow-tree
Dogwood
Elm
Hawthorn
Hickory
Maple
Melaleuca
Mulberry
Oak
Persimmon
Poplar
Privet
Red Alder
Red Maple
Russian Olive
Saltcedar
Sassafras
Sourwood
Sumac
Sweetgum
Willow
Yellow Poplar

Grasses

Annual Bluegrass
Bahagrass
Barnyardgrass
Beardgrass
Bermudagrass
Big Bluestem
Broadleaf Signalgrass
Canada Bluegrass
Cattail
Cheat
Cogongrass
Crabgrass
Crowfootgrass
Dallisgrass

Downy Brome
Fall Panicum
Feathertop
Fescue
Foxtail
Giant Reed
Goosegrass
Guineagrass
Italian Ryegrass
Itchgrass
Johnsongrass
Junglerice
Kentucky Bluegrass
Lovegrass
Maidencane
Orchardgrass
Panicum, Browntop
Panicum, Texas
Paragrass
Phragmites
Prairie Cordgrass
Prairie Threeawn
Quackgrass
Reed Canarygrass
Sandbur
Sandbur, Field
Sand Dropseed
Saltgrass
Signalgrass
Sprangletop
Timothy
Torpedograss
Vaseygrass
Wild Barley
Wild Oats
Wirestem Muhly
Witchgrass
Woolly Cupgrass

Broadleaf Weeds

Alligatorweed
Arrowwood
Broom Snakeweed
Bull Thistle
Burclover
Burdock
Canada Thistle
Carolina Geranium

Carpetweed
Chickweed, Mouseear
Clover
Clover, Hop
Cocklebur
Common Chickweed
Common Ragweed
Cudweed
Dandelion
Desert Camelthorn
Diffuse Knapweed
Dock
Dogfennel
Fiddleneck
Filaree
Fleabane
Giant Ragweed
Goldenrod
Grey Rabbitbrush
Henbit
Hoary Vervain
Horseweed
Indian Mustard
Japanese Bamboo
Knotweed, Prostrate
Kochia
Lambsquarters
Lespedeza
Little Mallow
Milkweed
Miners Lettuce
Mullein
Nettleleaf Goosefoot
Oxeye Daisy
Pepperweed
Pigweed
Pokeweed
Primrose
Puncturevine
Purple Loosestrife
Purslane
Pusley, Florida
Rocket, London
Rush Skeletonweed
Russian Knapweed
Russian Thistle
Salbush
Shepherdspurse

Silverleaf Nightshade
Smartweed
Sorrel
Sowthistle
Spurge, Annual
Stinging Nettle
Sunflower
Sweet Clover
Tansymustard
Texas Thistle
Velvetleaf
Wild Carrot
Wild Lettuce
Wild Parsnip
Wild Turnip
Woolyleaf Bursage
Yellow Starthistle
Yellow Woodsorrel

Vines and Brambles

Field Bindweed
Hedge Bindweed
Greenbriar
Honeysuckle
Kudzu
Morningglory
Poison Ivy
Redvine
Trumpet creeper
Virginia Creeper
Wild Buckwheat
Wild Brape
Wild Rose, including
Multiflora Rose and
Macartney Rose

The degree of control is species-dependent.
Some Rubus species may not be controlled.

For more information about **Arsenal PowerLine** or any of our vegetation management products, call your nearest BASF ProVM sales specialist or BASF Corporation at **1-800-545-9525**, or visit **www.vmanswers.com**.
