

128829 ✓  
SHAUGHNESSEY NO.

3  
REVIEW NO.

EEB BRANCH REVIEW

DATE: IN 11-19-84 OUT 1-16-85

FILE OR REG. NO. 241-EUP-RRU

PETITION OR EXP. PERMIT NO.

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740/EUP

TYPE PRODUCT(S): I. D. H, F. N, R, S Herbicide

DATA ACCESSION NO(S).

PRODUCT MANAGER NO. R. Taylor (25)

PRODUCT NAME(S) Arsenal Hebside

COMPANY NAME American Cyanamid Co.

SUBMISSION PURPOSE Proposed EUP s for use in forestry applications

SHAUGHNESSEY NO. CHEMICAL, & FORMULATION % A.I.

128829 Arsenal (propanamine salt) 53.6%



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## EEB BRANCH REVIEW

### Arsenal

#### 100 Submission Purpose and Label Information

##### 100.1 Submission Purpose and Pesticide Use

Arsenal is an herbicide used to control most annual and perennial grasses, broadleaf weeds and hardwood trees. The registrant has requested an Experimental Use Permit (EUP) for a forestry use of the pesticide.

##### 100.2 Formulation

###### Active Ingredient

2- 4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid with 2-propanamine (1:1) salt\* ..... 53.6%

Inert Ingredient ..... 46.4%

\* Equivalent to 43.3% 2-4,5-dihydro-4-methyl-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid or 4 pounds acid per gallon.

##### 100.3 Application Methods, Directions, Rates

Rates will vary with the type of vegetation to be controlled. Please refer to the attached label for target species and rates.

In general, biennial/perennial weeds should be treated at rates of 1 to 4 pints per acre (0.5 to 2 lbs. ai/acre; annual weeds at rates of 1 to 2 pints per acre (0.5 to 1.0 lb. ai/acre) and woody brush and trees at rates of 2 to 4 pints per acre (1.0 to 2 lbs/acre).

Higher rates should be used where heavy or well established infestations occur.

Applications will mostly be made by helicopter.

100.4 Target Organism

Please refer to the attached label.

100.5 Precautionary Labeling

Environmental Hazards

Do not apply directly to any body of water. Do not contaminate water by cleaning of equipment or disposal of waste.

Important

Do not use on food or feed crops. Do not apply where runoff water may flow into agricultural lands as injury to crops may result. Keep from contact with fertilizers, insecticides, fungicides and seeds. Do not apply or drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots. Prevent drift or spray to desirable plants. Do not use in California.

100.6 Proposed EUP Program

100.6.1 Objectives

"The objective of the EUP program is to evaluate ARSENAL as a herbicide in pines on 95 target pests, at 5 application timings, in two type uses (site preparation and conifer release), at four rates, in three pine species, in 12 states."

"Soil, foliage and water samples will be taken to determine dissipation rates."

100.6.2 Date, Duration

The herbicide will be applied from early spring to late fall in both 1985 and 1986.

100.6.3 Amount Shipped. Geographical Distribution

| <u>State</u>    | <u>Acreage</u><br><u>1985/1986</u> | <u>lbs a.i</u><br><u>1985/1986</u> |
|-----------------|------------------------------------|------------------------------------|
| Georgia         | 800/1400                           | 1200/2100                          |
| Alabama         | 800/1400                           | 1200/2100                          |
| North Carolina  | 200/300                            | 300/450                            |
| Arkansas        | 800/1300                           | 1200/1950                          |
| Mississippi     | 800/1400                           | 1200/2100                          |
| Virginia        | 200/300                            | 300/450                            |
| Florida         | 400/600                            | 600/900                            |
| Louisiana       | 800/1400                           | 1200/2100                          |
| Tennessee       | 200/300                            | 300/450                            |
| Texas           | 600/1000                           | 900/1500                           |
| South Carolilna | 200/300                            | 300/450                            |
| Oklahoma        | 200/300                            | 300/450                            |
|                 | <u>6,000/10,000</u>                | <u>9,000/15,000</u>                |

100.6.4 Other Test Features

An outline of the EUP program is attached.

101 Hazard Assessment

101.1 Discussion

According to the information in the proposed testing program, single application rates will vary from 0.75 to 2.0 lbs. ai/acre. Treatments will be made in early spring, late spring, mid-summer, early fall and late fall. Ground equipment or helicopters will be utilized to apply the chemical. Sites will be no less than 10 acres in size each.

Approximately 6,000 acres will be treated with 9,000 lbs active ingredient in 1985, and 10,000 acres will receive 15,000 lbs active ingredient in 1986. This is an average of 1.5 lbs active per acre each year of the program. The testing will be distributed over 12 states. Most of the sites are on paper company lands.

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## 101.2 Likelihood of Adverse Effects to Non-Target Organisms

### Terrestrial Organisms

Arsenal (technical product) is considered to be practically non-toxic to birds on both an acute oral basis (bobwhite quail and mallard duck LD<sub>50</sub>s are greater than 2,150 mg/kg) and a dietary basis (bobwhite quail and mallard duck LC<sub>50</sub>s greater than 5,000 ppm).

The available data on rats (LD<sub>50</sub> > 5000 mg/kg both sexes) suggests that the chemical has a low mammalian toxicity.

Significant acute hazards to populations of non-target terrestrial organisms are not anticipated from use of Arsenal in the proposed experimental program. This is mainly because the chemical is practically non-toxic to avian and mammalian species on an acute basis. Also, the test acreage is limited (6,000 and 10,000 acres scattered over 16 states). Most of the program will be executed within paper company lands.

EEB does not have sufficient data to characterize the chemical's potential for chronic affects to terrestrial wildlife species. The label directions do not clearly indicate the number and timing intervals for repeat applications. The chemical can be extremely persistent in the soil environment (1/2 life 7-months in sandy loam soil), however, EEB does not have information on the herbicide's behavior on/in vegetation.

### Aquatic Organisms

The available toxicity data on aquatic organisms indicate that this chemical is practically non-toxic to both warmwater and coldwater fish (96 hour LC<sub>50</sub>s were greater than 100 ppm for bluegill and rainbow trout). The 48 hour LC<sub>50</sub> greater than 100 ppm found for Daphnia magna, suggests a low toxicity to aquatic invertebrates.

At a 2 lb a.i./acre rate, the following maximum residues of active ingredient would be expected in an acre of water of varying depth:

| ft  | ppm   |
|-----|-------|
| 0.5 | 1.471 |
| 1.0 | 0.736 |
| 2.0 | 0.368 |
| 3.0 | 0.245 |

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Because these maximum concentrations do not approach an LC<sub>50</sub> greater than 100 ppm. or even 1/10 an LC<sub>50</sub> of 100 ppm, it is not anticipated that a single application of Arsenal will produce acute adverse effects to aquatic wildlife under the EUP.

The active ingredient of Arsenal is stable to hydrolysis under environmental conditions, however, the material has a photolytic half-life of about 5.3 days. The potential for a chronic exposure to aquatic species would be better assessed after label directions for repeat applications are made more clear and an EEC is generated.

#### 101.3 Endangered Species

Because of the limited scope of this experimental program and the low toxicity of the chemical to both terrestrial and aquatic organisms, use of Arsenal under the EUP is not expected to produce adverse effects to Federally Endangered/Threatened animal species. However, the chemical should not be applied in areas inhabited by endangered species. The registrant can contact local state and Federal Endangered Species Specialists for more detailed information.

It should be clearly indicated however, that under this EUP, there may be a possibility of adverse effects to a variety of endangered plant species as outlined in the forestry cluster Biological Opinion obtained from OES (dated October 25, 1984).

The following endangered plants occur in states included in the experimental program for Arsenal:

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Chapman rhododendron - Florida

Hairy rattleweed - Georgia

Persistent trillium - Georgia, South Carolina

Green pitcher plant - Georgia, Alabama

Virginia round-leaf birch - Virginia

Small whorled pogonia - North Carolina, South Carolina,  
Virginia

Florida torreya - Florida

Mountain golden heather - North Carolina

#### 101.4 Adequacy of Toxicity Data

No data were submitted with this action. The requirements for the six basic fish and wildlife studies using the technical are fulfilled.

The registrant should be made aware that a forestry use of a pesticide can directly contaminate aquatic habitats, thus acute testing on aquatic species (cold and warmwater fish and an invertebrate) using the formulated product may have to be performed.

The need for chronic testing (both for aquatic and terrestrial species) will be addressed when the label directions are made more explicit and sufficient environmental fate data are obtained.

#### 101.5 Adequacy of Labeling

To maintain consistency between products, all labels for Arsenal should contain the following statements:

"Do not apply directly to water or wetlands. Do not contaminate water by cleaning of equipment or disposal of waste."

## 102 Conclusions

Because of the limited scope of this experimental program and the relatively low toxicity of the technical material to both terrestrial and aquatic organisms, use of Arsenal under the EUP is not expected to produce adverse acute effects to non-target animal species.

Use of Arsenal under the EUP could potentially jeopardize eight Federally Endangered Threatened plant species (Please refer to Section 101.3 of this review).

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# 241-ELP-RRU

## SECTION G

Proposed Testing Program

## 1985 and 1986 EXPERIMENTAL USE PERMIT PROGRAM

### Objective:

The objective of the EUP program is to evaluate ARSENAL as an herbicide in pines on 95 target pests, at 5 application timings, in two type uses (site preparation and conifer release), at four rates, in three pine species, in 12 states.

### General Outline:

Current conifer release and site preparation herbicides are inadequate for several reasons. Most do not have a very broad weed control spectrum, and conifers have shown only minimal tolerance to current products. ARSENAL is expected to control a greater variety of weeds than any other herbicide: annuals and perennials including many difficult to control woody species. ARSENAL has also demonstrated a great degree of tolerance, greater than 2 x proposed application rates, on loblolly pine.

Program details are outlined in the next four tables. A description of the program preceeds the tables.

Table 1. Target Pests

Table 2. Application Timings, Rates, Size of Tests

Table 3. States, Acreage & Amount of Product - 1985 & 1986

Table 4. Participants

**PROPOSED EXPERIMENTAL USE PERMIT PROGRAM OF  
ARSENAL • HERBICIDE IN FORESTRY  
IN 1985 AND 1986**

Research trials conducted in 1983 and 1984 have demonstrated that ARSENAL herbicide will provide control of a wide range of herbaceous and hardwood weeds in loblolly pine (Pinus taeda) stands with excellent pine tolerance. The purpose of this program will be to establish trials using typical commercial application techniques to test the performance of ARSENAL at several rates under a variety of environmental conditions. Three extensive residue testing studies will also be established to monitor residue and residue dissipation in foliage, litter, soil and water. Protocols for these studies have been submitted to the EPA for review and approval.

The intended forestry use pattern of ARSENAL includes preplanting site preparation and conifer release:

Site preparation will involve treatment with 1.0-2.0 lbs ae/A of ARSENAL after harvesting a mature forest. This treatment will control herbaceous and woody species that are released when the overstory is removed. This allows pine planting and eliminates established vegetation that would compete for sun, water and nutrients. ARSENAL has demonstrated the broad spectrum control of vegetation needed for this use in addition to residual control of some herbaceous species. Seedling tolerance as yet needs to be evaluated.

Conifer release consists of treating 3-5 year old trees, infested with herbaceous and woody species, with a conifer tolerant herbicide. Control of the weeds, in particular the hardwoods, removes sun, water and nutrient competition and provides release of the less competitive softwoods. ARSENAL has demonstrated excellent control of some important weeds at rates that give acceptable, temporary injury to loblolly pines.

ARSENAL rates of 0.5-1.0 lb ae/acre will control many herbaceous weeds; annual and perennial grasses, broadleaves and vines. Initial results indicate that control of such competitive woody species as blackberry (Rubus spp.), cherry (Prunus spp.), red maple (Acer rubrum), sumac (Rhus spp.), and multiflora rose (Rosa multiflora), can be obtained with 2.0 lbs ae/acre. Replicated evaluation of ARSENAL activity on woody species is needed (see Table 1). In two trials loblolly pine was treated with up to 4.0 lb ae/A of ARSENAL. No mortality was noted from these treatments. Recovery from any injury occurred within one year. Loblolly pine is the major species that will be tested under the EUP, but evaluation of slash and longleaf pines will also be pursued.

Under the proposed Experimental Use Permit Program, ARSENAL herbicide will be applied by terrestrial and aerial (helicopter) equipment. The rate of ARSENAL will range from 0.75 to 2.0 lb ae/acre in order to evaluate weed control at various rates under a variety of environmental conditions. Although

herbicide applications will be made in only 1985 and 1986, the control of all herbaceous and woody species will be extensively evaluated in 1985, 1986 and 1987, with particular emphasis on the woody species (see Table 2). Pine growth response and any injury will be closely monitored. The growth response information will be important to Cyanamid, since testing of ARSENAL in forestry has been limited. The EUP will allow us to obtain replicated data that allows us to determine the extent of pine tolerance, in addition to the extent of control of various woody species. Initial results indicate that removal of surfactant may provide better tolerance with a concomittant decrease in weed control. This question will be answered by conducting some surfactant vs no surfactant trials. Trials will be located primarily on paper companies' private land.

Under this program ARSENAL will be distributed by American Cyanamid Company to cooperating paper companies and to Dr. J. Michael, U.S.D.A. Forest Service. Dr. Michael will conduct the forestry residue studies required for registration. The proposed EUP program will require 6,000 acres (9,000 pounds of active ingredient) in 1985 and 10,000 acres (15,000 pounds of active ingredient) in 1986 distributed in twelve states (see Table 3). Specific information on the proposed acreage to be treated in each state, the gallons of ARSENAL to be shipped and the names and qualifications of the individuals who will supervise the experimental work will be found in tables that follow.

The request for 6,000 and 10,000 acres in twelve states is based upon the variety of weed species found in pine forests, the variety of environments in which loblolly pines are grown and the size of commercial application equipment (10 acres is considered the minimum size plot which could be treated by helicopter, the most common application equipment). ARSENAL needs to be tested in cool, dry climates (AR, OK), cool, moist climates (TN, VA, NC), hot, dry climates (TX) and hot, wet climates (MS, AL, FL, GA, SC, LA). The soil types vary considerably within each of these environments. ARSENAL will be tested on the greatest variety of weed species possible. This will require significant spacing out of the trials in the states as most species are prevalent in limited areas. A smaller number of test sites is needed in the first year of testing, 1985, since information to date on ARSENAL use in site preparation is limited. Only 20%, 1200 acres of the 1985 allocation will be site preparation. A full 50%, 5000 acres of the 1986 allocation will be tested in site preparation. Acreage for pine release will remain essentially constant in 1985 and 1986.

The proposed experimental program will be two years in duration and all products not used during this period will be returned to American Cyanamid Company. Ms. A. M. VanCantfort, Program Coordinator, American Cyanamid Company, Agricultural Research Division, Princeton, New Jersey will be responsible for total coordination of this permit program (see Table 4).

Table 1

Target Woody Brush and Trees

|                          |                                    |
|--------------------------|------------------------------------|
| American Beautyberry     | ( <u>Callicarpa americana</u> )    |
| Alder                    | ( <u>Alnus spp.</u> )              |
| Green Ash                | ( <u>Fraxinus pennsylvanica</u> )  |
| White Ash                | ( <u>Fraxinus americana</u> )      |
| Azaleas                  | ( <u>Rhododendron spp.</u> )       |
| Basswood                 | ( <u>Tilia spp.</u> )              |
| Beech                    | ( <u>Fagus grandifolia</u> )       |
| River Birch              | ( <u>Betula nigra</u> )            |
| Sweet Birch              | ( <u>Betula lenta</u> )            |
| Yellow Birch             | ( <u>Betula lutea</u> )            |
| Black Cherry             | ( <u>Prunus serotina</u> )         |
| Box Elder                | ( <u>Acer negundo</u> )            |
| Buckeye                  | ( <u>Aesculua spp.</u> )           |
| Catalpa                  | ( <u>Catalpa spp.</u> )            |
| Cedar                    | ( <u>Jupiperus virginiana</u> )    |
| Cottonwood               | ( <u>Populus deltoides</u> )       |
| Cypress                  | ( <u>Chamaecyparis thyoides</u> )  |
| Dogwood                  | ( <u>Cornus spp.</u> )             |
| American Elm             | ( <u>Ulmus americana</u> )         |
| Rock Elm                 | ( <u>Ulmus thomasi</u> )           |
| Slippery Elm             | ( <u>Ulmus rubra</u> )             |
| Winged Elm               | ( <u>Ulmus alata</u> )             |
| Fetterbush               | ( <u>Eubotrys spp.</u> )           |
| Gooseberry               | ( <u>Ribes spp.</u> )              |
| Hawthorn                 | ( <u>Crataegus spp.</u> )          |
| Hazelnut                 | ( <u>Corylus spp.</u> )            |
| Bitternut Hickory        | ( <u>Carya cordiformis</u> )       |
| Pecan Hickory            | ( <u>Carya illinoensis</u> )       |
| Pignut Hickory           | ( <u>Carya ovalis</u> )            |
| Shagbark Hickory         | ( <u>Carya ovata</u> )             |
| Shellbark Hickory        | ( <u>Carya laciniata</u> )         |
| American Holly           | ( <u>Ilex opaca</u> )              |
| Common Winterberry Holly | ( <u>Ilex laevigata</u> )          |
| Gallberry Holly          | ( <u>Ilex coriacea</u> )           |
| Hornbeam                 | ( <u>Carpinus caroliniana</u> )    |
| Horsechestnut            | ( <u>Aesculus hippocasternum</u> ) |
| Huckleberry              | ( <u>Gaylussacia spp.</u> )        |
| Hydrangia                | ( <u>Hydrangea spp.</u> )          |
| Ironwood                 | ( <u>Ostrya virginiana</u> )       |
| Inkberry                 | ( <u>Ilex glabra</u> )             |
| Juniper                  | ( <u>Juniperus spp.</u> )          |
| Laurel                   | ( <u>Kalmia spp.</u> )             |
| Big Leaf Magnolia        | ( <u>Magnolia macrophylla</u> )    |
| Cucumber Magnolia        | ( <u>Magnolia acuminata</u> )      |
| Sweetbay Magnolia        | ( <u>Magnolia virginiana</u> )     |
| Umbrella Magnolia        | ( <u>Magnolia tripetala</u> )      |
| Black Maple              | ( <u>Acer nigrum</u> )             |
| Mountain Maple           | ( <u>Acer spicatum</u> )           |
| Red Maple                | ( <u>Acer rubrum</u> )             |
| Silver Maple             | ( <u>Acer saccharinum</u> )        |

Table 1. (continued)

|                  |                                    |
|------------------|------------------------------------|
| Sugar Maple      | ( <u>Acer barbatum</u> )           |
| Mulberry         | ( <u>Morus spp.</u> )              |
| Black Oak        | ( <u>Quercus velutina</u> )        |
| Blackjack Oak    | ( <u>Quercus marilandia</u> )      |
| Chestnut Oak     | ( <u>Quercus prinus</u> )          |
| Chinquapin Oak   | ( <u>Quercus prinoides</u> )       |
| Jack Oak         | ( <u>Quercus imbricaria</u> )      |
| Live Oak         | ( <u>Quercus virginiana</u> )      |
| Overcup Oak      | ( <u>Quercus lyrata</u> )          |
| Pin Oak          | ( <u>Quercus palustris</u> )       |
| Post Oak         | ( <u>Quercus stellata</u> )        |
| Red Oak          | ( <u>Quercus borealis</u> )        |
| Scarlet Oak      | ( <u>Quercus coccinea</u> )        |
| Scrub Oak        | ( <u>Quercus ilicifolia</u> )      |
| Spanish Oak      | ( <u>Quercus falcata</u> )         |
| Swamp Oak        | ( <u>Quercus bicolor</u> )         |
| Turkey Oak       | ( <u>Quercus laevis</u> )          |
| Water Oak        | ( <u>Quercus nigra</u> )           |
| Willow Oak       | ( <u>Quercus phellos</u> )         |
| Osage-orange     | ( <u>Madura pomifera</u> )         |
| Palmetto         | ( <u>Sabal palmetto</u> )          |
| Pecan            | ( <u>Carya illinoensis</u> )       |
| Persimmon        | ( <u>Diospyros virginiana</u> )    |
| Pepperbush       | ( <u>Clethra spp.</u> )            |
| Privet           | ( <u>Ligustrum spp.</u> )          |
| Redbud           | ( <u>Cercis canadensis</u> )       |
| Rhododendron     | ( <u>Rhododendron spp.</u> )       |
| Sassafras        | ( <u>Sassafras albidum</u> )       |
| Sourwood         | ( <u>Oxydendron arboreum</u> )     |
| Sweetgum         | ( <u>Liquidambar styraciflua</u> ) |
| Sycamore         | ( <u>Platanus spp.</u> )           |
| Ti Ti            | ( <u>Cyrilla racemiflora</u> )     |
| Black Tupelo     | ( <u>Nyssa sylvatica</u> )         |
| Vaccinium        | ( <u>Vaccinium spp.</u> )          |
| Viburnum         | ( <u>Viburnum spp.</u> )           |
| Butternut Walnut | ( <u>Juglans cinerea</u> )         |
| Black Walnut     | ( <u>Juglans nigra</u> )           |
| Waxmyrtle        | ( <u>Myrica cerifera</u> )         |
| Willow           | ( <u>Salix spp.</u> )              |
| Yellow Poplar    | ( <u>Liriodendron tulipifera</u> ) |
| Yucca            | ( <u>Yucca spp.</u> )              |
| Prickly Pear     | ( <u>Opuntia spp.</u> )            |
| Aspen            | ( <u>Populus tremuloides</u> )     |
| Alder            | ( <u>Alnus spp.</u> )              |
| Honey Locust     | ( <u>Gleditsia triacanthos</u> )   |

Table 2

Application Timings, Rates, Size of Tests

|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Timings:    | Early Spring<br>Late Spring<br>Mid Summer<br>Early Fall<br>Late Fall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Rates:      | 0.75, 1.0, 1.5 and 2.0 lb ae/acre for each application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Species:    | The major species to be evaluated is loblolly pine ( <u>Pinus taeda</u> ); however information on the injury to and growth response of other Southern pines [slash pine ( <u>Pinus elliottii</u> ) and longleaf pine ( <u>Pinus australis</u> )] will be collected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Test Size:  | <p>100 gallon spray tank; Spray delivery average 10 gpa. Treat approximately 10 acres per helicopter tank. Aerial spraying is very expensive and foresters strongly object to using less than a full tank. Additionally, evaluation of plots less than 10 acres in size is difficult because of the inhomogeneity of forests.</p> <p>Test 3 of 4 rates and 3 of 5 timings with 2 replicates per site. Two untreated checks (10 acres each) will be located in each site. If site specification necessitates, this test design may be divided between two or more locations. Twenty acres at each site are reserved for overage.</p> <p>TOTAL 200 acres/site, 30 or more sites in 1985 and 50 or more sites in 1986.</p> <p>In 1985 approximately 6 sites will be used for site preparation and 24 sites will be for conifer release. In 1986 approximately 25 sites will each be used for site preparation and conifer release.</p> <p>Three sites in 1985, c.a. 500 acres, will be used to obtain residue samples necessary for forestry registration. Soil, foliage and water samples will be taken to determine ARSENAL dissipation rates. The protocol for these studies has been submitted to the EPA for review and approval.</p> |
| Evaluation: | Weed control of hardwoods, vines, brambles, annuals and perennials will be evaluated 3 months after treatment (if appropriate) and one, two and three years after treatment. Pine injury and growth response will be measured in years one, two and three.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Table 3**  
**States, Acreage and Amount of Product**

1985

| <u>State</u>   | <u>Acreage</u> | <u>ARSENAL</u> |                |
|----------------|----------------|----------------|----------------|
|                |                | <u>lb ae</u>   | <u>gallons</u> |
| Georgia        | 800            | 1200           | 300            |
| Alabama        | 800            | 1200           | 300            |
| North Carolina | 200            | 300            | 75             |
| Arkansas       | 800            | 1200           | 300            |
| Mississippi    | 800            | 1200           | 300            |
| Virginia       | 200            | 300            | 75             |
| Florida        | 400            | 600            | 150            |
| Louisiana      | 800            | 1200           | 300            |
| Tennessee      | 200            | 300            | 75             |
| Texas          | 600            | 900            | 225            |
| South Carolina | 200            | 300            | 75             |
| Oklahoma       | 200            | 300            | 75             |
|                | 6,000          | 9,000          | 2,250          |

1986

| <u>State</u>   | <u>Acreage</u> | <u>ARSENAL</u> |                |
|----------------|----------------|----------------|----------------|
|                |                | <u>lb ae</u>   | <u>gallons</u> |
| Georgia        | 1400           | 2100           | 525            |
| Alabama        | 1400           | 2100           | 525            |
| North Carolina | 300            | 450            | 113            |
| Arkansas       | 1300           | 1950           | 488            |
| Mississippi    | 1400           | 2100           | 525            |
| Virginia       | 300            | 450            | 113            |
| Florida        | 600            | 900            | 225            |
| Louisiana      | 1400           | 2100           | 525            |
| Tennessee      | 300            | 450            | 113            |
| Texas          | 1000           | 1500           | 375            |
| South Carolina | 300            | 450            | 113            |
| Oklahoma       | 300            | 450            | 113            |
|                | 10,000         | 15,000         | 3,753          |



**Table 4**  
**Participants**

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**Total:**

1 Program Supervisor  
3 Regional Coordinators  
1 Market Development Manager  
9 Agriculturists  
1 Forestry Specialist

**ARSENAL® herbicide**

**Concentrate**

**FOR EXPERIMENTAL USE ONLY - IN FORESTRY**

**EPA EXPERIMENTAL USE PERMIT 241-EUP-**

**NOT FOR SALE TO ANY PERSON OTHER THAN A PARTICIPANT OR  
COOPERATOR OF THE EPA APPROVED EXPERIMENTAL USE PROGRAM**

**ACTIVE INGREDIENT:**

2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-  
imidazol-2-yl]-3-pyridinecarboxylic acid with 2-propanamine (1:1) salt. <sup>T</sup> . 53.6%

INERT INGREDIENT . . . . . 46.4%

<sup>T</sup> Equivalent to 43.3% 2-[4,5-dihydro-4-methyl-(1-methylethyl)-5-oxo-1H-  
imidazol-2-yl]-3-pyridinecarboxylic acid or 4 pounds acid per gallon.

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION!**

**See Side Panel for Other Precautions**

**PRECAUCION**

**PRECAUCION AL USUARIO:** Si usted no lee inglés, no use este producto  
hasta que la etiqueta le haya sido explicada  
ampliamente.

**In case of an emergency endangering life or property involving  
this product, call collect, day or night, Area Code 201-835-3100.**

**Net Contents: 1 Gallon  
(3.78 Liters)**

**EXP-1**

**AMERICAN CYANAMID COMPANY  
AGRICULTURAL DIVISION  
Bio-Tech Products Department  
WAYNE, NJ 07470**

®Registered trademark of American Cyanamid Company

(10/8/84)

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## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS

#### CAUTION!

Avoid contact with skin, eyes or clothing. Avoid breathing spray mist. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

#### FIRST AID

**IF ON SKIN:** Wash with plenty of soap and water.

**IF IN EYES:** Flush with plenty of water. Get medical attention if irritation persists.

### PHYSICAL AND CHEMICAL HAZARDS

Spray solutions of ARSENAL should be mixed, stored and applied only in stainless steel, fiberglass, plastic and plastic-lined steel containers.

DO NOT mix, store or apply ARSENAL or spray solutions of ARSENAL in unlined steel (except stainless steel) containers or spray tanks.

### ENVIRONMENTAL HAZARDS

DO NOT apply directly to any body of water. DO NOT contaminate water by cleaning of equipment or disposal of waste.

### STORAGE AND DISPOSAL

**PROHIBITIONS:** DO NOT store below 10°F. DO NOT contaminate water, food or feed by storage or disposal.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in an approved sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## IMPORTANT

**DO NOT** use on food or feed crops. **DO NOT** apply where runoff water may flow onto agricultural land as injury to crops may result. Keep from contact with fertilizers, insecticides, fungicides and seeds. **DO NOT** apply or drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots. Prevent drift of spray to desirable plants. **DO NOT** use in California.

Thoroughly clean application equipment immediately after use. Flush tank, pump, hoses and boom with several changes of water after removing nozzle tips and screens (clean these parts separately).

## GENERAL INFORMATION

ARSENAL herbicide is an aqueous solution to be mixed in water and applied as a spray for control of most annual and perennial grasses, broadleaf weeds and hardwood trees for site preparation and release of loblolly pine stands.

ARSENAL is readily absorbed through foliage and roots and is translocated rapidly throughout the plant, with accumulation in the meristematic regions. Treated plants stop growing soon after spray application. Chlorosis appears first in the newest leaves, and necrosis spreads from this point. In perennials and hardwoods, the herbicide is translocated into and kills underground storage organs, thus preventing regrowth. Chlorosis and tissue necrosis may not be apparent in some plant species until two weeks after application. Complete kill of plants may not occur for several weeks.

## DISCLAIMER

American Cyanamid Company warrants only that the material contained herein conforms to the chemical description on the label and is reasonably fit for the use therein described when used in accordance with the directions for use, subject to the risks referred to above.

Any damages arising from a breach of this warranty shall be limited to direct damages and shall not include consequential commercial damages such as loss of profits or values or any other special or indirect damages.

American Cyanamid Company makes no other express or implied warranty, including other express or implied warranty of FITNESS or of MERCHANTABILITY.

User assumes the risk of any use contrary to label instructions or under abnormal conditions, or under conditions not reasonably foreseeable by American Cyanamid Company.

## DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

ARSENAL herbicide should be used only in accordance with recommendations on this label. Keep containers closed to avoid spills and contamination.

A postemergence application of ARSENAL is recommended for control of most annual and perennial grasses, broadleaf weeds and hardwoods in release of loblolly pine stands or in site preparation prior to planting loblolly pines. Some pine phytotoxicity and tip burn may occur after application, but pine survival is excellent. ARSENAL may be applied anytime during the growing season after leaves have emerged and before leaf fall. Pine phytotoxicity may be greater from spring application than from summer or fall application when the candles have hardened off.

## MIXING INSTRUCTIONS

Mix the proper amount of ARSENAL in water in the spray tank with the agitator running. Increased control of herbaceous and hardwood weeds with decreased loblolly pine tolerance can be obtained by adding a nonionic surfactant such as SURFACTANT WK\*\* or Ortho \*\*\* X-77 at the rate of 1 quart per 100 gallons of spray. This provides optimum wetting and/or contact activity. To minimize drift, a drift control agent may be added at the recommended label rate. A foam-reducing agent may be added at the recommended label rate, if needed.

## SPRAYING INSTRUCTIONS

Uniformly apply with properly calibrated aerial or ground equipment in 5 to 60 gallons of water per acre with a spray pressure of 20 to 50 psi.

\*\*Registered trademark of E. I. duPont de Nemours and Company.

\*\*\*Registered trademark of Chevron Chemical Company

ARSENAL herbicide will provide postemergence control with residual control of the following weed species at the rates listed.

## BIENNIAL/PERENNIAL WEEDS

Apply 1-1.5 pints per acre

Dandelion (Taraxacum officinale)  
Field bindweed (Convolvulus arvensis)  
Guineagrass (Panicum maximum)  
Johnsongrass (Sorghum halepense)  
Multiflora rose (Rosa multiflora)  
Ox-eye daisy (Chrysanthemum leucanthemum)  
Paragrass (Brachiaria mutica)  
Quackgrass (Agropyron repens)  
Sandspur (Cenchrus spp.)  
Tall fescue (Festuca arundinacea)  
Vaseygrass (Paspalum urvillei)  
Wild carrot (Daucus carota)

Apply 1.5-2 pints per acre

Dewberry (Rubus spp.)  
Greenbriar (Smilax spp.)  
Honeysuckle (Lonicera spp.)  
Opossum grape (Cissus sicyoides)  
Poison ivy (Rhus radicans)  
Redvine (Brunnichia cirrhosa)  
Trumpet creeper (Campsis radicans)  
Virginia creeper (Parthenocissus quinquefolia)

Apply 2-3 pints per acre

Bermudagrass (Cynodon dactylon)  
Blackberry (Rubus spp.)  
Canada thistle (Cirsium arvense)

## WOODY BRUSH AND TREES

Apply 2-4 pints per acre

Mulberry (Morus spp.)  
Sumac (Rhus spp.)  
Maple (Acer spp.)  
Dogwood (Cornus spp.)  
Sassafras (Sassafras albidum)  
Cherry (Prunus spp.)  
Birch (Betula spp.)

## ANNUAL WEEDS

Apply 1-1.5 pints per acre

Broadleaf signalgrass (Brachiaria platyphylla)  
Carpeweed (Mollugo verticillata)  
Common ragweed (Ambrosia artemisiifolia)  
Curly dock (Rumex crispus)  
Downy brome (Bromus tectorum)  
Fleabane (Erigeron spp.)  
Foxtails (Setaria spp.)  
Goldenrod (Solidago spp.)  
Hoary vervain (Verbena stricta)  
Kochia (Kochia scoparia)  
Lambsquarters (Chenopodium album)  
Lespedeza (Lespedeza spp.)  
Horseweed (Erigeron canadensis)  
Pigweed (Amaranthus spp.)  
Plaintain (Plantago spp.)  
Smartweed (Polygonum spp.)  
Sorrel (Rumex spp.)  
Sowthistle (Sonchus spp.)  
Sunflower (Helianthus annuus)  
Wild buckwheat (Polygonum convolvulus)  
Wild mustard (Brassica kaber)  
Yellow woodsorrel (Oxalis stricta)

Apply 1.5-2 pints per acre

Cocklebur (Xanthium spp.)  
Crabgrass (Digitaria spp.)  
Goosegrass (Eleusine indica)  
Morningglory (Ipomoea spp.)

Honeylocust (Gleditsia triacanthos)  
Sweetgum (Liquidambar styraciflua)  
Hawthorn (Crataegus spp.)  
Oak (Quercus spp.)  
Tupelo (Nyssa spp.)  
Hickory (Carya spp.)

The higher rates should be used where heavy or well established infestations occur.