

**Date of Approval: December 31, 2003**

**FREEDOM OF INFORMATION SUMMARY**

**Supplement to NADA 140-338**

**NAXCEL Sterile Powder  
(ceftiofur sodium)**

**“For updating the package insert by providing additional clinical  
microbiology data”**

**SPONSORED BY:**

**PHARMACIA & UPJOHN**

**Table of Contents**

1. GENERAL INFORMATION	Page 3
2. EFFECTIVENESS	Page 5
3. TARGET ANIMAL SAFETY	Page 10
4. HUMAN FOOD SAFETY	Page 10
5. AGENCY CONCLUSIONS	Page 11
6. ATTACHMENTS	Page 11

**1. GENERAL INFORMATION:**

- a. File Number: NADA 140-338
- b. Sponsor: Pharmacia & Upjohn Co.  
7000 Portage Rd.  
Kalamazoo, MI 49001-0199  
Drug Labeler Code: 000009
- c. Established Name: ceftiofur sodium
- d. Proprietary Name: NAXCEL Sterile Powder
- e. Dosage Form: Sterile powder for reconstitution
- f. How Supplied: 1 gram and 4 gram vials
- g. How Dispensed: R<sub>x</sub>
- h. Amount of Active Ingredient: Each mL of the reconstituted solution contains ceftiofur sodium equivalent to 50 mg ceftiofur.
- i. Route of Administration: intramuscular (IM) and subcutaneous (SC) injections
- j. Species/class: cattle, swine, sheep, goats, dogs, horses, day-old chickens, and day-old turkey poult
- k. Recommended Dosage:
- |                       |  |
|-----------------------|--|
| Cattle:               | 0.5 to 1.0 mg ceftiofur/lb body weight<br>IM or SC.          |
| Swine:                | 1.36 to 2.27 mg ceftiofur/lb body weight<br>IM only.         |
| Sheep:                | 0.5 to 1.0 mg ceftiofur/lb body weight<br>IM only.           |
| Goat:                 | 0.5 to 1.0 mg ceftiofur/lb body weight<br>IM only.           |
| Horse:                | 1 to 2 mg ceftiofur/lb body weight IM only.                  |
| Dog:                  | 1 mg/lb body weight SC only.                                 |
| Day-old chick:        | 0.08 to 0.20 mg ceftiofur/chick once<br>in the neck SC only. |
| Day-old turkey poult: | 0.17 to 0.5 mg ceftiofur/poult<br>once in the neck SC only.  |

l. Pharmacological Category: antimicrobial

m. Indications:

- Cattle:** NAXCEL Sterile Powder is indicated for the treatment of bovine respiratory disease (shipping fever, pneumonia) associated with *Mannheimia haemolytica*, *Pasteurella multocida* and *Haemophilus somnus*. NAXCEL Sterile Powder is also indicated for treatment of acute bovine interdigital necrobacillosis (foot rot, pododermatitis) associated with *Fusobacterium necrophorum* and *Bacteroides melaninogenicus*.
- Swine:** NAXCEL Sterile Powder is indicated for treatment/control of swine bacterial respiratory disease (swine bacterial pneumonia) associated with *Actinobacillus (Haemophilus) pleuropneumoniae*, *Pasteurella multocida*, *Salmonella choleraesuis* and *Streptococcus suis* type 2.
- Sheep:** NAXCEL Sterile Powder is indicated for treatment of sheep respiratory disease (sheep pneumonia) associated with *Mannheimia haemolytica* and *Pasteurella multocida*.
- Goat:** NAXCEL Sterile Powder is indicated for treatment of caprine respiratory disease (goat pneumonia) associated with *Mannheimia haemolytica* and *Pasteurella multocida*.
- Horse:** NAXCEL Sterile Powder is indicated for the treatment of respiratory infections in horses associated with *Streptococcus zooepidemicus*.
- Dog:** NAXCEL Sterile Powder is indicated for the treatment of canine urinary tract infections associated with *Escherichia coli* and *Proteus mirabilis*.
- Day-old Chicken:** NAXCEL Sterile Powder is indicated for the control of early mortality, associated with *Escherichia coli* organisms susceptible to ceftiofur, in day-old chicks.

- Day-old Turkey Poult:** NAXCEL Sterile Powder is indicated for the control of early mortality, associated with *Escherichia coli* organisms susceptible to ceftiofur, in day-old turkey poults.
- n. Effect of this Supplement: This supplement provides four specific changes to the product insert, 1) revision of the “clinical microbiology” section to update the MIC table using the new MIC data for ceftiofur, 2) the addition of a table listing acceptable quality control ranges for ceftiofur, 3) the addition of the latest National Committee for Clinical Laboratory Standards (NCCLS) reference at the end of the insert, and 4) clarification of the statement under “Storage Conditions” dealing with the storage of reconstituted Naxcel via freezing.

## 2. **EFFECTIVENESS:**

Updated *in vitro* minimum inhibitory concentration (MIC) data for cattle, swine, sheep, chicken, and turkey pathogens are presented in tabular format in the labeling for NAXCEL Sterile Powder.

In the revised package insert, MIC data for bacterial isolates collected during clinical field studies have been placed in Table 1. Bacterial isolates collected over time, including those collected from diagnostic laboratories in the US and Canada as part of a surveillance program, are in Table 2. MICs were determined using a commercially available broth microdilution system that conforms to the guidelines for the National Committee for Clinical Laboratory Standards (NCCLS) broth microdilution method. Data from the QA organisms tested with each run are included in each study report.

In the clinical field studies isolate table (Table 1), data previously included on the EXCENEL RTU (NADA 140-890) package insert is now included in the NAXCEL package insert. Table 1 is the updated table with data for all bacterial isolates collected during clinical field studies.

**Table 1. Ceftiofur MIC values of bacterial isolates from clinical field studies in the USA**

<b>Animal</b>	<b>Organism</b>	<b>Number Tested</b>	<b>Date Tested</b>	<b>MIC<sub>90</sub>* (µg/mL)</b>	<b>MIC Range (µg/mL)</b>
<b>Bovine</b>	<i>Mannheimia haemolytica</i>	461	1988-1992	0.06	≤ 0.03-0.13
	<i>Mannheimia haemolytica</i>	42	1993	0.015	≤ 0.003-0.03
	<i>Pasteurella multocida</i>	318	1988-1992	0.06	≤ 0.03-0.25
	<i>Pasteurella multocida</i>	48	1993	≤ 0.003	≤ 0.003-0.015
	<i>Haemophilus somnus</i>	109	1988-1992	0.06	≤ 0.03-0.13
	<i>Haemophilus somnus</i>	59	1993	≤ 0.0019	no range
	<i>Fusobacterium necrophorum</i>	17	1994	≤ 0.06	no range
<b>Swine</b>	<i>Actinobacillus pleuropneumoniae</i>	83	1993	≤ 0.03	≤ 0.03-0.06
	<i>Pasteurella multocida</i>	74	1993	≤ 0.03	≤ 0.03-0.06
	<i>Streptococcus suis</i>	94	1993	0.25	≤ 0.03-1.0
	<i>Salmonella choleraesuis</i>	50	1993	1.0	1.0-2.0
	<i>Beta hemolytic streptococcus spp.</i>	24	1993	≤ 0.03	≤ 0.03-0.06
	<i>Actinobacillus suis</i>	77	1998	0.0078	0.0019-0.0078
	<i>Haemophilus parasuis</i>	76	1998	0.06	0.0039-0.25
<b>Sheep</b>	<i>Mannheimia haemolytica</i>	39	1992	0.13	≤ 0.03-0.13
	<i>Pasteurella multocida</i>	23	1992	≤ 0.03	no range
<b>Canine</b>	<i>Escherichia coli</i>	44	1992	4.0	0.06-64.0
	<i>Escherichia coli</i>	18	1990	0.25	0.13-0.5
	<i>Proteus mirabilis</i>	17	1990	≤ 0.06	≤ 0.06-0.5
	<i>Proteus mirabilis</i>	23	1992	1.0	≤ 0.06-4.0
<b>Turkey</b>	<i>Escherichia coli</i>	1204	1995	1.0	0.13->32.0

\*Minimum inhibitory concentration (MIC) for 90% of the isolates.

The diagnostic lab isolate table (Table 2) contains some MIC data that were previously included on the NAXCEL package insert. The remaining data are from study reports from the last four years of a surveillance program and other MIC surveys.

**Table 2. Ceftiofur MIC values of bacterial isolates from diagnostic laboratories\* in the USA and Canada**

Animal	Organism	Number Tested	Date Tested	MIC <sub>90</sub> ** (µg/mL)	MIC Range (µg/mL)
Bovine	<i>Mannheimia haemolytica</i>	110	1997-1998	0.06	≤ 0.03-0.25
	<i>Mannheimia haemolytica</i>	139	1998-1999	≤ 0.03	≤ 0.03-0.5
	<i>Mannheimia haemolytica</i>	209	1999-2000	≤ 0.03	≤ 0.03-0.12
	<i>Mannheimia haemolytica</i>	189	2000-2001	≤ 0.03	≤ 0.03-0.12
	<i>Pasteurella multocida</i>	107	1997-1998	≤ 0.03	≤ 0.03-0.25
	<i>Pasteurella multocida</i>	181	1998-1999	≤ 0.03	≤ 0.03-0.5
	<i>Pasteurella multocida</i>	208	1999-2000	≤ 0.03	≤ 0.03-0.12
	<i>Pasteurella multocida</i>	259	2000-2001	≤ 0.03	≤ 0.03-0.12
	<i>Haemophilus somnus</i>	48	1997-1998	≤ 0.03	≤ 0.03-0.25
	<i>Haemophilus somnus</i>	87	1998-1999	≤ 0.03	≤ 0.03-0.125
	<i>Haemophilus somnus</i>	77	1999-2000	≤ 0.03	≤ 0.03-0.06
	<i>Haemophilus somnus</i>	129	2000-2001	≤ 0.03	≤ 0.03-0.12
	<i>Bacteroides fragilis</i> group	29	1994	16.0	≤ 0.06->16.0
	<i>Bacteroides</i> spp., non-fragilis group	12	1994	16.0	0.13->16.0
	<i>Peptostreptococcus anaerobius</i>	12	1994	2.0	0.13-2.0
Swine	<i>Actinobacillus pleuropneumoniae</i>	97	1997-1998	≤ 0.03	no range
	<i>Actinobacillus pleuropneumoniae</i>	111	1998-1999	≤ 0.03	≤ 0.03-0.25
	<i>Actinobacillus pleuropneumoniae</i>	126	1999-2000	≤ 0.03	≤ 0.03-0.06
	<i>Actinobacillus pleuropneumoniae</i>	89	2000-2001	≤ 0.03	≤ 0.03-0.06
	<i>Pasteurella multocida</i>	114	1997-1998	≤ 0.03	≤ 0.03-1.0
	<i>Pasteurella multocida</i>	147	1998-1999	≤ 0.03	≤ 0.03-0.5
	<i>Pasteurella multocida</i>	173	1999-2000	≤ 0.03	≤ 0.03-0.06
	<i>Pasteurella multocida</i>	186	2000-2001	≤ 0.03	≤ 0.03-0.12
	<i>Streptococcus suis</i>	106	1997-1998	0.5	≤ 0.03-4.0
	<i>Streptococcus suis</i>	142	1998-1999	0.25	≤ 0.03-1.0
	<i>Streptococcus suis</i>	146	1999-2000	0.06	≤ 0.03-4.0
	<i>Streptococcus suis</i>	167	2000-2001	0.06	≤ 0.03-4.0
	<i>Salmonella choleraesuis</i>	96	1999-2000	1.0	0.03->4.0
	<i>Salmonella choleraesuis</i>	101	2000-2001	1.0	0.5-2.0
	<i>Erysipelothrix rhusiopathiae</i>	44	2002	≤ 0.03	≤ 0.03-0.06
Equine	<i>Streptococcus equi</i> subsp. <i>equi</i>	12	1994	≤ 0.0019	no range
	<i>Streptococcus zooepidemicus</i>	48	1994	≤ 0.0019	no range
	<i>Rhodococcus equi</i>	66	1998	4.0	≤ 0.03-16.0
	<i>Bacteroides fragilis</i> group	32	1995	> 16.0	0.13->16.0

**Table 2 (cont'd). Ceftiofur MIC values of bacterial isolates from diagnostic laboratories\* in the USA and Canada**

Animal	Organism	Number tested	Date tested	MIC <sub>90</sub> ** (µg/mL)	MIC range (µg/mL)
Equine	<i>Bacteroides</i> spp., non-fragilis group	12	1995	4.0	0.25-4.0
	<i>Fusobacterium necrophorum</i>	16	1995	≤ 0.06	no range
Canine	<i>Escherichia coli</i>	26	2000	32	0.25->32
	<i>Proteus mirabilis</i>	14	2000	0.25	0.06-0.25
Turkey	<i>Escherichia coli</i>	17	1998-1999	1.0	0.25-1.0
	<i>Escherichia coli</i>	25	1999-2000	0.50	0.12-0.50
	<i>Escherichia coli</i>	20	2000-2001	2.0	0.12-16
	<i>Citrobacter</i> spp.	37	1995	32.0	0.5->32.0
	<i>Enterobacter</i> spp.	51	1995	> 32.0	0.13->32.0
	<i>Klebsiella</i> spp.	100	1995	1.0	0.13-2.0
	<i>Proteus</i> spp.	19	1995	1.0	0.06-32.0
	<i>Pseudomonas</i> spp.***	31	1995	>32.0	0.06->32.0
	<i>Salmonella</i> spp.	24	1995	1.0	0.5-1.0
	<i>Staphylococcus</i> spp. (coagulase-positive)	17	1995	2.0	1.0-2.0
	<i>Staphylococcus</i> spp. (coagulase-negative)	26	1995	8.0	0.13->32.0
Chicken	<i>Escherichia coli</i>	62	1997-1998	0.50	0.25-2.0
	<i>Escherichia coli</i>	53	1998-1999	4.0	0.25->4
	<i>Escherichia coli</i>	67	1999-2000	0.50	0.12-16
	<i>Escherichia coli</i>	90	2000-2001	1.0	≤ 0.03-8

\*The following *in vitro* data are available but their clinical significance is unknown.

\*\*Minimum inhibitory concentration (MIC) for 90% of the isolates.

\*\*\*MIC<sub>50</sub> is 32 µg/mL

Based on the pharmacokinetic studies of ceftiofur in swine and cattle after a single intramuscular injection of 1.36 to 2.27 mg ceftiofur equivalents/lb (3.0 to 5.0 mg/kg) body weight (swine) or 0.5 to 1.0 mg ceftiofur equivalents/lb (1.1 to 2.2 mg/kg) BW (cattle) and the MIC and disk (30 µg) diffusion data, the following breakpoints are recommended by NCCLS.

Zone diameter (mm)	MIC (µg/mL)	Interpretation
≥ 21	≤ 2	(S) Susceptible
18-20	4.0	(I) Intermediate
≤ 17	≥ 8.0	(R) Resistant

A report of "Susceptible" indicates that the pathogen is likely to be inhibited by generally achievable blood levels. A report of "Intermediate" is a technical buffer zone and isolates falling into this category should be retested. Alternatively the organism may be successfully treated if infection is in a body site where the drug is physiologically concentrated. A report of "Resistant" indicates that the achievable drug concentrations are unlikely to be inhibitory and other therapy should be selected.



Standardized procedures recommended by NCCLS require the use of laboratory control organisms for both diffusion techniques and dilution techniques. The 30 µg ceftiofur sodium disk should give the following zone diameters and the ceftiofur sodium standard reference powder (or disk) should provide the following MIC values for the reference strains (Table 3). Ceftiofur sodium disk or powder reference standard is appropriate for both ceftiofur salts.

**Table 3. Acceptable quality control ranges for ceftiofur against National Committee for Clinical Laboratory Standards recommended American Type Culture Collection (ATCC) reference strains**

Organism Name (ATCC Number)	Zone Diameter * (mm)	MIC Range (µg/ml)
<i>Escherichia coli</i> (25922)	26-31	0.25-1.0
<i>Staphylococcus aureus</i> (29213)	--	0.25-1.0
<i>Staphylococcus aureus</i> (25923)	27-31	--
<i>Pseudomonas aeruginosa</i> (27853)	14-18	16.0-64.0
<i>Actinobacillus pleuropneumoniae</i> (27090)	34-42**	0.004-0.015***
<i>Haemophilus somnus</i> (700025)	36-46**	0.0005-0.004***

\*All testing performed using a 30 µg disk.

\*\* Quality control ranges are applicable only to tests performed by disk diffusion test using a chocolate Mueller-Hinton agar, incubated in 5-7% CO<sub>2</sub> for 20-24 hours.

\*\*\*MIC quality control ranges are applicable only to tests performed by broth microdilution procedures using veterinary fastidious medium (VFM).

The references supporting the data provided in the revised clinical microbiology tables are listed below.

- a. Portis, E.S., S.A. Salmon, C.A. Case, J.L. Watts. Results of 1997-1998 resistance monitoring program for premafloxacin with veterinary pathogens. Pharmacia & Upjohn Study Report a0032820, 9 February 1999.
- b. Portis, E.S., S.A. Salmon, C.A. Case, J.L. Watts. Results of 1998-1999 susceptible monitoring program for premafloxacin with veterinary pathogens. Pharmacia & Upjohn Study Report a0086065, 19 September 2000.
- c. Portis, E.S., S.A. Salmon, C.A. Case. Results of 2000 susceptibility monitoring program for ceftiofur with veterinary pathogens. Pharmacia Animal Health Study Report a0097495, 27 June 2001.
- d. Portis, E.S., S.A. Salmon, C. Lindeman, C.A. Case. Results of 2001 susceptibility monitoring program for ceftiofur with veterinary pathogens. Pharmacia Animal Health Study Report SR-0829-7922-2002-006, 20 August 2002.
- e. Lindeman, C., S.A. Salmon, E.S. Portis, C.A. Case. Minimum inhibitory concentration determinations for ceftiofur and comparators against *Erysipelothrix rhusiopathiae* isolated from pigs in Iowa. Pharmacia Animal Health Study Report SR-0788-7922-2002-001, 1 July 2002.

- f. Portis, E.S., S.A. Salmon. Minimum inhibitory concentration determinations for ceftiofur, desfuroylceftiofur, and cefpodoxime against bacterial pathogens of canines. Pharmacia Animal Health Study Report SR-0850-7922-2002-001, 24 June 2002.
- g. Salmon, S.A., J.L. Watts. Minimum inhibitory concentration determinations for various antimicrobials agents against 1570 bacterial isolates from turkey poults. 2000. *Avian Diseases*. **44**:85-98.

#### CONCLUSIONS:

The updated clinical microbiology tables provide the following:

- a. Updated clinical microbiology data and interpretive criteria for cattle and swine.
- b. An insert format that is user friendly by having all of the important information for a particular animal species in one section of the table, with isolates supported by clinical data in a separate table from isolates collected from diagnostic laboratories.
- c. The practicing veterinarian will have more information that can be readily located on the insert to assist in making sound recommendations for the use of NAXCEL Sterile Powder.

#### **3. TARGET ANIMAL SAFETY:**

This supplement to NADA 140-338 does not change the target animal safety data for this product.

#### **4. HUMAN FOOD SAFETY:**

This supplement to NADA 140-338 does not change the human food safety data for this product.

**5. AGENCY CONCLUSIONS:**

The data submitted in support of this supplemental NADA satisfy the requirements of Section 512 of the Federal Food, Drug, and Cosmetic Act and 21 CFR Part 514.1 of the implementing regulations. The updated clinical microbiology data presented in the product insert is user friendly by having all the important use information for a particular animal species in one section of the insert. As a result, the practicing veterinarian will have more information that can be readily located on the insert to assist in making sound therapy recommendations for the use of NAXCEL Sterile Powder.

The product remains a prescription drug for safe and effective use by a veterinarian in the treatment of diseases in cattle, swine, sheep, goats, dogs, horses, day-old chicks and day-old turkey poults.

This approval does not qualify for marketing exclusivity under section 512(c)(2)(F)(iii) of the Federal Food, Drug, and Cosmetic Act.

In accordance with 21 CFR 514.106(b)(2), this is a Category II change which did not require a reevaluation of the safety and effectiveness data in the parent application.

**6. ATTACHMENTS:**

Facsimile labeling of the package insert is attached to this document.