

STATE OF COLORADO

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Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

August 30, 2006

REGULATORY COMPLIANCE NOTICE – UPDATE: Epinephrine Waste Management

Dear Health Care Administrator,

This regulatory Compliance Notice is provided as an update and correction to the June 12, 2006 Regulatory Compliance Notice sent to you regarding the regulation of epinephrine wastes. After further review of the regulations and the underlying chemistry of epinephrine, the Department has determined that materials contaminated by epinephrine salts are **not** hazardous waste and/or do **not** need to be managed as hazardous waste.

In practice, this means that all aqueous solutions containing epinephrine salts (which should include essentially all medical applications) and all wastes associated with the use of these solutions, including vials, ampules, bottles, bags, tubing, and syringes, are not hazardous wastes and not subject to hazardous waste regulations. These wastes are, however, solid wastes and medical wastes and still need to be managed in compliance with solid waste requirements.

We regret any hardships our June 12, 2006 letter caused. Prior to that letter, we were unaware of the widespread use of epinephrine salt solutions in medical applications and were concerned that many in the medical community were unaware that epinephrine was a chemical that EPA added to the list of acutely hazardous wastes back in 1980. Our initial research leading up to the June 12 letter indicated that many states considered the epinephrine wastes to be hazardous wastes. In addition, many medical waste resource groups, such as H2E (Healthy Hospitals for the Environment), also advised the medical community to consider all epinephrine wastes to be hazardous. It was against that backdrop, but before we performed our own research into the issue, that the June 12, 2006 letter was sent to you.

Background

Pure epinephrine (or epinephrine base; CAS 51-43-4; $C_9H_{13}NO_3$) appears in the Colorado hazardous waste regulations as a P042 listed acutely hazardous waste. This form of epinephrine is a weak nitrogenous base and a secondary amine and has a low solubility in water principally because it has no formal charge. However, solubility increases significantly in mineral acid and sodium hydroxide and potassium hydroxide solutions as the epinephrine accepts a proton in a reversible acid-base reaction forming an aqueous hydroxyl-amine salt (protonated form; $C_9H_{14}NO_3^+$). For instance, epinephrine base will dissolve in aqueous buffer solutions at pH 7.4 with analogous salt formation and these solutions are

widely used in medical applications. Many amino compounds like epinephrine are used as drugs, and these drugs are administered as their water-soluble salts rather than their water-insoluble “free base” amine form.

In other medical applications, an epinephrine salt is the listed ingredient in the solution being utilized. The most common salt in these solutions is epinephrine hydrochloride, but epinephrine bitartrate and others are also used. In these solutions, the same protonated ion is present along with a negatively charged counter ion.

Colorado has determined that epinephrine salt solutions containing the protonated ion are not P042 listed hazardous waste for the following reasons:

- 1) Epinephrine base is a different compound than any of the epinephrine salts. As different compounds, these substances have different chemical and physical properties - solubilities, melting points, etc. They also have different CAS numbers. EPA has specifically listed some acutely toxic chemicals on the P-list to include the salts of those chemicals. Examples include warfarin, strychnine, nicotine, and others. Epinephrine salts are not included in the P042 listing for epinephrine in section 261.33(e). We conclude that not including epinephrine salts in the P042 listing was a deliberate decision on EPA’s part.
- 2) The most common epinephrine salt is epinephrine hydrochloride. As explained above, this is a different chemical than the P042 epinephrine base with different chemical properties. Epinephrine hydrochloride is widely manufactured for medical applications and sold in varying concentration for different uses. As such, it is a different commercial chemical product than the epinephrine base that is listed as P042. Because it is widely manufactured and sold for direct application, it is not a manufacturing chemical intermediate.

For your information, through our “Waste Management at Health Care Facilities” Workgroup, we are continuing to work with the health care industry to define best management practices for hazardous wastes, pharmaceutical wastes, and other potentially dangerous wastes that are generated in hospitals and other health care facilities. For any questions regarding epinephrine or other waste streams generated at your facility, or if you would like to know more about the Workgroup, you may contact Nancy Newell of my staff at (303) 692-3351.

Sincerely,

Joe Schieffelin, Program Manager
Solid and Hazardous Waste Program
Hazardous Materials Waste Management Division