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General Accounting Office
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Resources, Community, and
Economic Development Division



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February 27, 1997

The Honorable John McCain
Chairman, Committee on Commerce,
Science, and Transportation
United States Senate

Subject: Airfield Pavements: Use of Sealer/Rejuvenators to Extend the Life of Airfields

Dear Mr. Chairman:

Since 1989, 77 airports have used coal tar-based pavement products to rejuvenate and prolong the life of aging pavement and seal it against fuel spills. Thirty-six of these airports received grants under the Federal Aviation Administration's (FAA) Airport Improvement Program (AIP) to pay for the work.¹ Concerns have been raised that some of these sealer/rejuvenator products may not comply with FAA's guidance—Engineering Brief 44 (EB-44)—on the material content of, physical properties of, and the requirements for coal tar and coal tar oils in the products.²

This report responds to your request that we determine (1) whether the sealer/rejuvenator products used on federally funded projects comply with the

¹The database for FAA's Airport Improvement Program does not always differentiate sealer/rejuvenator projects from other pavement rehabilitation projects. Therefore, we were unable to derive from the database an accurate total dollar amount of federal funds spent on sealer/rejuvenator projects.

²FAA's guidance on the use of pavement sealer/rejuvenators is contained in Engineering Brief 44, issued in November 1989. FAA's engineering briefs provide information and guidance regarding materials that may be used on federally funded airport projects. EB-44 provides a general outline for the use of pavement sealer/rejuvenator products.

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guidance in FAA's EB-44 and how FAA ensures that sealer/rejuvenator products comply with EB-44 and (2) what has been the experience of airports in using these products.

RESULTS IN BRIEF

Independent laboratory test results conducted for airports and us showed that sealer/rejuvenator products used on federally funded projects comply with FAA's guidance. In monitoring compliance with this guidance, FAA does not conduct its own independent tests of these products or validate that such tests have been done. Instead, as with other products approved for AIP funding, FAA relies primarily on the airports to ensure that the products meet FAA's guidance. On the basis of our survey of all airports using federal funds during the period fiscal year 1989 through fiscal year 1996 for sealer/rejuvenator products, all airports provided such assurances to FAA mainly through certifications obtained from the manufacturers.

Our survey found that airport officials report general satisfaction with sealer/rejuvenator products to date, but the actual performance test results of the products' effectiveness are limited. As general guidance, EB-44 does not provide airports with an indication of the degree to which the products should repel spilled fuel or enhance the life of pavements but, rather, an indication of what the products should contain. FAA acknowledges the limitations of its guidance and plans, in consultation with industry and airport officials, to issue a general performance-based specification for sealer/rejuvenator products.

BACKGROUND

Airports use coal tar-based pavement sealer/rejuvenators to extend the life of asphalt runways, taxiways, and aprons. When applied, sealer/rejuvenators are meant to simultaneously seal and penetrate the pavement's surface; that is, part of the sealer/rejuvenator material permeates the asphalt and restores its flexibility, while the other portion remains on the surface to protect the pavement against damage from fuel spills, air, and water.

FAA first allowed sealer/rejuvenator products to be eligible for AIP funding in 1989 after an Air Force study³ and data from a sealer/rejuvenator manufacturer indicated that such products could have a positive effect on airport pavements. The Air Force conducted its study to evaluate the effectiveness of rejuvenators on aging military airfield pavements. The study provided some performance data indicating that rejuvenators prolonged the life of pavements. However, only one of the products currently available was available at the time of the study. FAA also used other data provided by a sealer/rejuvenator manufacturer

³U.S. Army Engineer Waterways Experiment Station, *Evaluation of Rejuvenators for Bituminous Pavements* (AFCEC-TR-76-3, Feb. 1976).

that showed that the sealer/rejuvenator reconditioned the asphalt, thus prolonging the useful life of the pavements.

SEALER/REJUVENATOR MANUFACTURERS CERTIFY
COMPLIANCE WITH EB-44

The three sealer/rejuvenator products used on AIP-funded airport pavement projects comply with EB-44's guidance.⁴ The guidance states that the product shall have a certain material content, specific physical properties, and coal tar and coal tar oils in the product. According to FAA officials, to demonstrate compliance, a sealer/rejuvenator product must undergo a series of tests to (1) determine the type of material used to create the product, (2) examine the physical properties of the product (such as its specific gravity and its softening point), and (3) ascertain that coal tar and coal tar oils are present in the product. These tests can be performed either by the manufacturer or by an independent laboratory on behalf of an airport. FAA does not conduct individual product tests or certify that such tests have been done. Instead, as with other AIP-funded projects, airport officials sign a series of grant assurances as a condition of receiving federal funding for airport projects, including a general assurance that policies, such as EB-44, are being followed.⁵

To provide assurance that EB-44 is followed, airport officials typically rely on manufacturers' certifications.⁶ We surveyed 36 airports that had at least one AIP-funded sealer/rejuvenator project completed from fiscal year 1989 through fiscal year 1996 and found that in each case, the airport assured FAA that its products complied with EB-44. According to officials at the 36 airports, all airports used certifications provided by the manufacturers, but in addition, 4 airports conducted independent tests to check compliance.

To ensure that each product complies with FAA's guidance, we requested independent test results from FAA, airports, states, manufacturers, and engineering consultants that would determine the material content, physical properties, and presence of coal tar and coal tar oils for each manufacturer's product. If independent laboratory test results of a product were not available, we obtained product samples from airport projects and coal tar manufacturers

⁴The three products are (1) CBRT-SO, manufactured by E.A. Mariani Asphalt Company, Tampa, Florida; (2) CI-5, manufactured by Bitumen Supply, Inc., Houston, Texas; and (3) PDC, manufactured by K.A.E. Paving Consultants, Inc., Pittsburgh, Pennsylvania.

⁵All airport officials must sign a series of grant assurances as a condition of receiving federal funds for airport projects. The grant assurances are incorporated by reference into the grant agreement. FAA requires that airport officials ensure that all airport projects will be carried out in accordance with policies, standards, and specifications approved by the Secretary of Transportation, including—but not limited to—the advisory circulars listed in the current *FAA Advisory Circulars* for AIP projects.

⁶EB-44 does not require airports to independently test the sealer/rejuvenator products.

and submitted them to independent laboratories for assessment. (See encl. I for testing information.) The independent laboratory tests showed that all three manufacturers' products comply with EB-44.

AIRPORTS REPORT GENERAL SATISFACTION WITH SEALER/REJUVENATORS TO DATE, BUT FEW TESTS TO MEASURE PERFORMANCE HAVE BEEN UNDERTAKEN

Thirty-two of the 36 airports that used coal tar sealer/rejuvenators on AIP projects during the period fiscal year 1989 through fiscal year 1996 reported general satisfaction with the performance of the pavements following the application of the sealer/rejuvenator products.⁷ For example, the airport manager at Lake Havasu City, Arizona, where sealer/rejuvenator products were applied to the entire airfield in November 1995, said he was very pleased with the performance. The airport manager said that routine airfield maintenance costs have diminished since the application of the sealer/rejuvenator. According to the manager, prior to the sealer/rejuvenator's application, many small pavement particles on the airfield had to be swept off on a regular basis—now the airfield rarely requires sweeping. The Chief of Airport Pavements, City of Houston, Department of Aviation, said that he is satisfied with the performance of sealer/rejuvenator products applied to several runways and taxiways at Houston Intercontinental Airport. He said that the sealer/rejuvenator-treated pavements appeared to have fewer new small cracks than untreated surfaces.

Three of 36 airports we contacted indicated that they had received some complaints from businesses and residents around the airport about strong odors associated with the application of certain sealer/rejuvenator products.⁸ In one case, an airport hired consultants to monitor the air quality during the application of the sealer/rejuvenator; the consultant found no air quality hazards. The Director, Airport Safety and Standards, FAA, said that FAA was aware of complaints about odor during the application of certain sealer/rejuvenator products. The Director said that, to the best of his knowledge, the odor is unpleasant but not hazardous. According to the airport officials at the three locations, the odor dissipated within hours of application and did not affect airport officials' general satisfaction with the sealer/rejuvenator products.

⁷The remaining four airports indicated that they were neither satisfied nor dissatisfied with the coal tar sealer/rejuvenator products applied to their airfields. Officials from two of the airports—one that used CBRT-SO and one that used PDC—said that since they had completed their sealer/rejuvenator projects in the summer of 1996, it was too soon to tell whether the product would be effective on their airfields. Officials at the third airport said that the sealer/rejuvenator applied to their airport—PDC—did not perform as they had expected but noted that the product might have had an adverse reaction to prior pavement treatments. Officials from the fourth airport said the sealer/rejuvenator—PDC—took too long to cure.

⁸Two of the airports that complained of a nuisance odor used CI-5; one of the airports that complained of a nuisance odor used PDC.

Most airports using sealer/rejuvenators had not measured the performance of sealer/rejuvenators on their pavements and such tests are not required by FAA. For those airports that did measure performance, the results were somewhat mixed. For example, the Florida Department of Transportation Aviation Office conducted an independent test at Dunnellon Municipal Airport that demonstrated that the asphalt's rate of deterioration was temporarily reversed on the sealed and rejuvenated pavements. The Missouri Department of Transportation, Multimodal Operations Division, Aviation Section, conducted studies at four airports using the same sealer/rejuvenator product. The studies showed an improvement at two airports, no change at one airport, and an increase in the pavement's brittleness at one airport. A study conducted for Rio Grande Valley International Airport in Harlingen, Texas, on 30-year-old pavement showed no improvement following the test application of a sealer/rejuvenator product on the airfield.

We found no comprehensive independent tests comparing the performance of the sealer/rejuvenator products of the three manufacturers. Sealer/rejuvenator manufacturers provided us with test results showing that pavements were improved after the product was applied. However, FAA has not verified the accuracy or validity of these test results and continues to rely instead on data presented in the 1976 Air Force study. The Air Force study's relevance is limited in that it only included performance data for one of the three sealer/rejuvenator products because the others were not introduced until 1995.

Airport officials and sealer/rejuvenator manufacturers expressed some concern that the guidance included in EB-44 is not specific enough to ensure that all sealer/rejuvenator products will be fuel resistant and rehabilitate the pavement. The tests mentioned in EB-44 address a sealer/rejuvenator's content but not its performance. For example, an engineer who is responsible for several airport projects in New Mexico and Arizona said that guidance in EB-44 is so vague that any number of products could demonstrate compliance. Moreover, the engineer said that EB-44 does not provide any assurance that these products will perform the dual task of sealing and rejuvenating the pavement.

Sealer/rejuvenator manufacturers stated that a product could meet the guidance of EB-44 but may not be fuel resistant or rehabilitate the pavement in part because of the composition of the individual products. EB-44 does not specify the exact composition of materials to use when manufacturing the sealer/rejuvenator product. However, some manufacturers believe the percentage of coal tar oils contained in the product may affect its performance on the pavement. Because of the disagreement over the guidance, most airport officials and sealer/rejuvenator manufacturers agree that FAA should require performance-based measures in any new specification that may be developed. FAA agrees that EB-44 needs modification and has initiated the process of preparing new guidance.

In July 1996, FAA drafted and circulated a revised EB-44 but discarded it after two manufacturers raised numerous concerns about the draft. As a result of these concerns, FAA decided to issue a general, performance-based standard for sealer/rejuvenator products. FAA held a meeting of all manufacturers of sealer/rejuvenator products in September 1996 to obtain their input on a proposed performance-based specification. The manufacturers agreed that the new specification should measure performance through tests to show how certain properties of the pavement change after the sealer/rejuvenator is applied.

In November 1996, FAA sent a draft specification—one that included proposed performance measures—to interested parties, including manufacturers and airports, for comment.⁹ The proposed performance measures specify, for example, that certain changes must occur to a pavement within 24 hours after the sealer/rejuvenator has been applied and be maintained over a 2-year period. FAA plans to issue the final specification in the spring of 1997.

AGENCY COMMENTS

We provided the Department of Transportation with a draft of this report for review and comment. We met with officials of the Department, including FAA's Director for Airport Safety and Standards and the Manager of the Engineering and Specifications Division, who said that the report accurately reflected the facts regarding fuel resistant sealer/rejuvenators and EB-44.

SCOPE AND METHODOLOGY

We interviewed and obtained documentation from FAA officials in Washington, D.C., and the Alaskan, Central, Eastern, Great Lakes, Northwest Mountain, Southern, Southwest, and Western-Pacific Regions on pavement sealer/rejuvenators and their use on federally funded airport projects. We also discussed pavement sealer/rejuvenators with the state aviation departments in Arizona, Florida, Missouri, New Mexico, North Dakota, and Texas. To verify the sealer/rejuvenators' compliance with EB-44, we interviewed and obtained documentation from all three product manufacturers. In addition, we obtained product samples from airport projects and coal tar manufacturers and had them tested by independent labs. (See encl. I.)

To ascertain whether FAA ensured that sealer/rejuvenator products comply with EB-44 and to obtain information regarding the experience of airports using these products, we conducted a telephone interview, using a standard set of

⁹The proposed specification will be issued as an amendment to Advisory Circular 150/5370-10A, "Standards for Specifying Construction of Airports." FAA officials said that engineering briefs, such as EB-44, are often used as guidance for new products. Once the products have been used successfully over a period of years, FAA converts the engineering brief into a more permanent specification.

questions, with each airport sponsor using sealer/rejuvenators on federally funded projects. (See encl. II.) We obtained a 100-percent response rate from the telephone interviews. In addition, we attended an FAA-sponsored meeting of sealer/rejuvenator representatives to discuss a new performance-based specification. We conducted our review from August 1996 through February 1997 in accordance with generally accepted government auditing standards.

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We are sending copies of this report to the Secretary of Transportation and the Administrator, FAA. We will make copies available to others on request. Please contact me on (202) 512-3650 if you or your staff have any questions about this report. Major contributors to this report were Sarah Brandt, Dana Greenberg, Stan Stenersen, Mindi Weisenbloom, and Randy Williamson.

Sincerely yours,



Gerald L. Dillingham
Associate Director, Transportation Issues

Enclosures - 2

INDEPENDENT TESTING OF SEALER/REJUVENATOR PRODUCTS

To respond to the first objective—to determine whether the sealer/rejuvenator products used on federally funded projects comply with the guidance in the Federal Aviation Administration's (FAA) Engineering Brief 44 (EB-44)—we sought independent test results for each of the three sealer/rejuvenator products. To demonstrate its compliance with EB-44, FAA officials said that a sealer/rejuvenator product must undergo a series of tests to (1) determine the type of material used to create the product, (2) examine the physical properties of the product (such as its specific gravity and its softening point), and (3) ascertain whether coal tar and coal tar oils are present in the product. To obtain the independent test results, we contacted airport officials at each airport that received federal funds for a sealer/rejuvenator project to inquire if independent tests were conducted on the product. In addition, we contacted FAA, manufacturers, engineering consultants, and aviation departments in states that have used sealer/rejuvenator products. We found limited independent test results available, as shown in table I.1 below.

Table I.1: Available Independent Tests on Sealer/rejuvenator Products

Product	Results of independent tests to determine the type of material used to create the product	Results of independent tests to examine the physical properties of the product	Results of independent tests to ascertain whether coal tar and coal tar oils are present in the product
PDC	No independent test results found.	No independent test results found.	No independent test results found.
CBRT-SO	Caldwell Industrial Airport (Idaho), Apr. 17, 1996. Material met specification.	Caldwell Industrial Airport (Idaho), May 5, 1996. Material met specifications.	No independent test results found.
CI-5	No independent test results found.	Lake Havasu City Airport (Arizona), Nov. 13, 1995. Material met specifications.	No independent test results found.

In order to fully respond to the objective, we made provisions for the remaining independent tests.

SELECTING LABORATORIES

We requested that FAA and airport officials identify laboratories that could conduct the three series of tests necessary to demonstrate compliance with EB-44. FAA and airport

officials suggested that we contact Chicago Testing Laboratory, Inc. (CTL). CTL had performed tests for Caldwell, Idaho (see table I.1 above) and was capable of conducting two of the three series of tests necessary to demonstrate the products' compliance with EB-44. The other labs that we considered were unable to perform the complete test and, in two cases, would have subcontracted the test to CTL.¹ Therefore, we selected CTL to (1) determine the types of materials used to create the product PDC and the product CI-5 and (2) examine the physical properties (such as the specific gravity and the softening point) of PDC.

For the third series of tests—ascertaining the presence of coal tar and coal tar oils in the product—airport and other laboratory officials suggested four laboratories (Calcoast Analytical, Phoenix Chemical Laboratory, Professional Services Inc. (PSI), and Herguth Laboratories, Inc.)²; we selected Calcoast Analytical to conduct the coal tar analysis for all three products. Calcoast Analytical used the distillation of the product, followed by gas chromatography/mass spectroscopy to identify the compounds in the distillation fraction to detect the presence of coal tar and coal tar oils.

OBTAINING SEALER/REJUVENATOR PRODUCT SAMPLES

We obtained product samples from actual airport projects to ensure that the products were created for an airport project and not for analysis purposes alone. We selected samples from airport projects at Sebastian, Florida (for CBRT-SO) and Ruidoso, New Mexico (for CI-5 and PDC). The samples were procured by airport officials or their consulting engineers. For the samples of coal tar obtained to determine the types of materials used to create the products, we acquired manufacturers' certifications that the samples provided directly by the manufacturers consisted of the same materials used to make each product.

All of the samples were shipped to the labs following procedures for hazardous materials of the Department of Transportation's Research and Special Programs Administration. The samples were shipped in packaging that complied with federal guidelines, and each shipment contained a material safety data sheet outlining the potential health hazards associated with each product.

¹Three other sources, Professional Services Inc.; Western Technologies, Inc.; and the Florida Department of Transportation, State Material Office, had also conducted independent tests for airports or manufacturers. However, none of these labs were able to conduct one of the tests (Engler viscosity) required to demonstrate compliance with the physical properties requirements of EB-44.

²At CTL's suggestion, we contacted Phoenix Chemical Laboratory. A Phoenix Chemical laboratory official said that he could determine the presence of coal tar and coal tar oils through chemical, physical, and spectrographic techniques. PSI had previously done some coal tar analysis on one of the products, but a laboratory official said that PSI no longer had the expertise to conduct this type of analysis. A laboratory official from Herguth Laboratories, Inc., said that her lab would not do this sort of analysis on coal tar.

AIRPORTS USING COAL TAR SEALER/REJUVENATORS ON PROJECTS
UNDER THE AIRPORT IMPROVEMENT PROGRAM, FISCAL YEARS 1989-96

<u>Airport</u>	<u>City</u>	<u>State</u>	<u>Year</u>	<u>Product</u>
1. Albany County	Albany	NY	1996	CBRT-SO
2. Ainsworth Municipal	Ainsworth	NE	1994	PDC
3. Ann Arbor Municipal ^a	Ann Arbor	MI	1996	PDC
4. Bartow Municipal	Bartow	FL	1995	PDC
5. Brainerd-Crow Wing County	Brainerd	MN	1992	PDC
6. Brazoria County	Angleton	TX	1995	PDC
7. Burnet Municipal/Kate Craddock ^{a,b}	Burnet	TX	1993	PDC
8. Caldwell Industrial ^b	Caldwell	ID	1996	CBRT-SO
9. Cavern City Air Terminal	Carlsbad	NM	1993	PDC
10. Central Nebraska Regional	Grand Island	NE	1996	CI-5
11. Clovis Municipal	Clovis	NM	1994	PDC
12. Corpus Christi International	Corpus Christi	TX	1994	PDC
13. Dexter Municipal ^a	Dexter	MO	1993	PDC
14. Du Bois-Jefferson County	Du Bois	PA	1989	PDC
15. Easterwood Field	College Station	TX	1995	PDC
16. Ernest A. Love Field ^b	Prescott	AZ	1993	PDC
17. Four Corners Regional	Farmington	NM	1995	PDC
18. Gallup Municipal	Gallup	NM	1994	PDC
19. Greenbrier Valley	Lewisburg	WV	1995	PDC
20. Houston Intercontinental ^b	Houston	TX	1993	PDC
21. Jamestown Municipal	Jamestown	ND	1996	PDC
22. Kansas City Downtown	Kansas City	MO	1993	PDC
23. Kayenta	Kayenta	AZ	1996	CI-5
24. Lake Havasu City ^b	Lake Havasu	AZ	1995	CI-5
25. Lincoln Municipal	Lincoln	NE	1996	CI-5
26. Lordsburg Municipal	Lordsburg	NM	1996	PDC
27. Morgantown Municipal	Morgantown	WV	1995	PDC
28. New Braunfels Municipal ^a	New Braunfels	TX	1995	PDC
29. Pocatello Municipal	Pocatello	ID	1993	PDC
30. Raton Municipal/Crews Field	Raton	NM	1994	PDC
31. Robert Mueller Municipal ^c	Austin	TX	1992/93	PDC
32. Santa Fe County Municipal ^b	Santa Fe	NM	1993	PDC
33. Scott City Municipal	Scott City	KS	1993	PDC
34. Scotts Bluff County/Heilig Field	Scottsbluff	NE	1995	PDC
35. Sierra Blanca Regional	Ruidoso	NM	1995	PDC
36. Wichita Mid-Continent ^c	Wichita	KS	1992/93	PDC

^a Airport project funded under State Block Grant Program.

^b Indicates projects visited by GAO.

^c Airport had more than one rejuvenator project funded with grants by the Airport Improvement Program.

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