GAO

United States General Accounting Office

Report to Congressional Requesters

November 1988

RAILROAD SAFETY

Accidents in Pennsylvania and Related Federal Enforcement Actions

GAO/RCED-89-52

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-230678

November 3, 1988

The Honorable John Heinz
The Honorable Arlen Specter
United States Senate

The Honorable Joseph M. Gaydos
House of Representatives

In response to your request and subsequent discussions with Senator Heinz' office, we developed statistical profiles of railroad safety in Pennsylvania and the nation, from 1984 through 1987, and we reviewed Federal Railroad Administration investigations of railroad accidents in Pennsylvania from January 1987 through January 1988.

As arranged with Senator Heinz' office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies of this report to Representatives William J. Coyne and George W. Gekas, who made similar requests that were incorporated in our work. We will also send copies to interested congressional committees and members; the Secretary of Transportation; the Administrator, Federal Railroad Administration; the Chairman, National Transportation Safety Board; the American Association of Railroads, and other interested parties and will make copies available to others upon request.

Major contributors to the report are listed in appendix III.

Kenneth M. Mead
Associate Director

Executive Summary

Purpose

In 1987, there were 307 train accidents and incidents in Pennsylvania ("accidents" result in over $5,200 in damages; "incidents," less than that amount). Thirty-five persons were killed and 195 were injured; 12,360 residents were forced to evacuate their homes following hazardous material releases; and damage to railroad property amounted to $6.6 million, as reported to the Federal Railroad Administration (FRA) by the involved rail carriers.

Concerned over these accidents, Senators Heinz and Specter and Representative Gaydos asked GAO to (1) develop a statistical profile of railroad safety in Pennsylvania and the nation and (2) review FRA's investigation of recent accidents in Pennsylvania, including its determination of the causes of the accidents, and FRA's follow-up on these accidents.

Background

FRA's safety mission includes (1) the establishment of federal rail safety rules and standards, (2) inspection of rail carrier track and equipment and investigation of serious accidents, and (3) enforcement of federal rules and standards. FRA selects certain accidents to investigate directly—in 1987, about 9 percent of the most serious accidents nationally. Generally, it selects accidents involving a fatality or serious injuries or those of strong public interest, such as ones resulting in hazardous materials releases.

Results in Brief

Overall, the number of accidents and incidents decreased in Pennsylvania and the nation between 1984 and 1987. Slight increases did occur in Pennsylvania between 1986 and 1987 in the number of derailments, highway crossing accidents, and accidents involving hazardous materials. However, the significance of the number of accidents in Pennsylvania is not clear, because rail operations in the state may have decreased or increased from year to year, varying the state's level of exposure to rail accidents. We could not determine the extent to which this occurred because FRA collects data from the carriers on their national, but not state or regional, level of operations. Having regional and state carrier operating data could enhance FRA management's efficiency in targeting inspections and other special efforts on carrier operations within its regions or in particular states.

FRA's inspectors attributed most of the 21 accidents it investigated in Pennsylvania between January 1987 and January 1988 to a combination of primary and contributing cause factors. GAO's findings are based on

the FRA regional office's reports on these accidents, as submitted to FRA headquarters, and discussions with the regional inspection staff. Operational errors were implicated in eight accidents; track problems, in seven accidents; rail equipment, in one accident; and vandalism, in two accidents. Track problems were suspected in two accidents and rail equipment problems in two others, but FRA could not definitely attribute these four accidents to these factors.

FRA cited a violation of its safety regulations and assessed a fine in 1 of the 21 accidents. No standards were violated in two accidents caused by vandalism, and four accidents were judged by FRA to be of undetermined cause. FRA did not follow up with enforcement action in the remaining 14 accidents, either because its regulations did not specifically address the factors that caused the accidents or because FRA could not establish the carrier's prior knowledge of a noncompliant track that contributed to the accident.

Principal Findings

Accidents Decrease but Data Limit Safety Analyses

Between 1984 and 1987, the total number of accidents and incidents in the nation decreased overall from 12,246 to 8,816. In Pennsylvania, the total number of accidents and incidents also decreased between 1984 and 1987 from 486 to 307, but the number of derailments, highway crossing accidents, and accidents involving hazardous cargo increased somewhat from 1986 to 1987.

It is important to interpret the number of Pennsylvania accidents in the context of train operations. For example, an increase in train operations in Pennsylvania in 1987 could explain the increases in some types of accidents in terms of increased exposure. For this reason, accident rates—for example, the number of accidents per 1 million miles of train operation—are preferred as a measure of safety. Because train operations data by state were not available from FRA, we could not interpret the changes in the numbers of accidents in Pennsylvania as gains or losses in rail safety.

Carrier operations are multistate, and FRA does not require them to report train operating mileage by state or region—data that could be used to calculate accident rates by state or by FRA region. According to FRA officials, the cost of requiring such data would be high, and in any

case, they have lacked the staff to perform a benefit-cost analysis. If regional and state accident rate data were available, FRA could use them to detect deviations from national accident rates and rail safety trends within a state or a region. For example, such differences may be based on state and regional level differences in terrain, climate, and numbers of rail/highway crossings.

Most Accidents Not Followed by FRA Enforcement

Well before the federal government assumed a regulatory role, the rail industry and its individual carriers established standards for safe equipment and operations. However, only the FRA rules and standards are subject to federal enforcement, that is, the assessment of fines against carriers. FRA's enforcement policy is to assess civil penalties against carriers for every case of noncompliance with its regulations. However, FRA inspectors are given flexibility in recommending civil penalties on the basis of the seriousness of the condition or the railroad's history of compliance. In the case of track standards, however, FRA requires the establishment of a carrier's prior knowledge of the noncompliance before assessing penalties. Individual carriers discipline their own employees for infringements of agreed-upon industry and carrier-unique rules and standards. According to FRA officials, FRA refrains from rail safety rulemaking when it believes industry rules or standards are adequate.

FRA cited a violation of its safety standards in 1 of the 21 accidents it investigated. It enforced its standards in this case by fining the carrier the maximum amount allowed—$2,500—after establishing that the carrier had prior knowledge of the track defect that caused a derailment resulting in a hazardous material release and evacuation of 950 people.

Reasons for No Enforcement

Following six accidents, no enforcement was taken either because FRA's inspectors could not determine the cause to their satisfaction or the accidents were caused by vandalism and no standards were violated.

In 11 of the remaining 14 accidents, GAO found that FRA took no enforcement action because (1) FRA's safety regulations did not address the factor attributed as causing the accident or (2) the accidents were caused by track problems that were covered by FRA regulations but were within allowable ranges. These accidents resulted in 10 fatalities, 49 injuries, 2,500 persons evacuated because of hazardous materials releases, and $6 million in damage to railroad equipment and property.

For example, collisions were attributed to operational errors, such as failure to observe a stop signal; and although industry and many carrier-specific rules do cover operational errors, FRA regulations generally do not. FRA officials acknowledged that they have the authority to establish operational rules and to penalize carriers for violations of such rules by carrier employees but have chosen not to do so. In addition, FRA received authority in 1988 to penalize individual rail employees who willfully violate FRA's rules.

In other accidents, track irregularities were cited as either a primary or contributing cause. While FRA's regulations include track standards, the particular track irregularities cited in these accidents were within allowable ranges. The operating errors cited as contributing to these accidents were not addressed by FRA regulations. While it did not find a basis for enforcement action in most of the accidents, FRA has followed up on similar accident cause factors with research programs to determine the underlying causes of track problems.

In two of the remaining three accidents, FRA determined that the available evidence did not meet its requirements for citing a violation of its track standards and therefore did not take an enforcement action. The third accident was attributed in part to a violation of FRA's speed standard, which FRA generally expects the carriers to enforce. These accidents accounted for about $1 million in railroad property damages.

GAO's review of FRA's accident investigations in Pennsylvania was too limited to adequately assess how well FRA's policies—that is, not regulating where FRA believes the industry has effective rules and relying on industry self-enforcement—are working overall. This broader issue will be the subject of another GAO review.

Recommendations

GAO is not making recommendations in this report.

Agency Comments

GAO discussed its findings with responsible FRA officials and incorporated their comments into the report where appropriate. However, as agreed with the requester's office, GAO did not obtain official agency comments on a draft of this report.

Contents

Abbreviations

AAR	Association of American Railroads
Amtrak	National Railroad Passenger Corporation
ATS	Automatic Train Stop
Chessie	Chessie System Railroad
C&O	Chesapeake and Ohio Railroad
Conrail	Consolidated Rail Corporation
CSX	CSX Transportation
DOT	Department of Transportation
FRA	Federal Railroad Administration
GAO	General Accounting Office
HM	hazardous material
mph	miles per hour
NTSB	National Transportation Safety Board
P&LE	Pittsburgh and Lake Erie Railroad
SEPTA	Southeastern Pennsylvania Transportation Authority

Introduction

The Federal Railroad Safety Act of 1970, as amended, states that the Secretary of Transportation "shall (1) prescribe, as necessary, appropriate rules, regulations, orders, and standards for all areas of railroad safety supplementing provisions of law and regulations in effect on the date of enactment of this title, and (2) conduct, as necessary, research, development, testing, evaluation, and training for all areas of railroad safety." The safety act also made it unlawful for any railroad to disobey, disregard, or "fail to comply with any rule, regulation, order, or standard prescribed by the Secretary," and required that "any railroad violating any rule, regulation, order, or standard. . .shall be assessed by the Secretary the civil penalty applicable to the standard violated. Each day of such violation shall constitute a separate offense."

FRA's Rail Safety Mission and Programs

The Secretary of Transportation's responsibilities under the Rail Safety Act have been delegated to the Federal Railroad Administration (FRA.) FRA's safety mission includes (1) the establishment of federal rail safety rules and standards, (2) inspection of rail carrier track and equipment and investigation of accidents, and (3) enforcement of federal rules and standards.

FRA's rail safety regulations contain federal rules and standards that implement provisions of the rail safety statutes. Its regulations contain specific standards for, among other things, track, equipment, and signals. For example, FRA has established maintenance standards for six classifications of track and standards for handling hazardous materials shipments. The railroad industry, through the Association of American Railroads (AAR), has established its own standards and rules, including rules for rail operations and specifications for the design, construction, maintenance, repair, and inspection of railroad cars and equipment. FRA only enforces its regulations that involve the assessment of civil penalties (fines). According to FRA officials, the industry's rules are enforced by the actions of individual carriers that discipline their own employees for infringements of agreed-upon industry or carrier-unique rules and standards.

FRA has established eight regional offices throughout the nation staffed with safety inspectors whose job it is to ensure the railroads comply with federal safety standards and rules. FRA's field inspector force is organized around five discipline areas: locomotive power and equipment, operating practices, track, signal and train control, and hazardous materials. Each field inspector is assigned a discipline on the basis of his or her knowledge and experience and is responsible for ensuring that

the railroads comply with federal safety standards for the discipline by carrying out, among other things, routine safety inspections and accident investigations. While inspectors primarily focus their attention on their own area of expertise, if they notice violations in other discipline areas during the course of an inspection, they are authorized to cite carriers for a violation.

When field inspectors identify a deviation from federal safety standards (FRA uses the term "defect"), they have two options: (1) they may file a notice of that defect with the railroad or (2) they may propose to FRA headquarters that enforcement action be taken—that is, formally cite the railroad for a violation of federal standards and assess a civil penalty (a fine). Prior to 1988, FRA could impose fines ranging from $250 to $2,500. The Rail Safety Improvement Act of 1988 raised the maximum fine to $20,000. FRA grants broad discretion to its field inspectors in deciding whether to follow through on a given defect by filing a defect notice with the railroad or by initiating a violation citation.

The regional offices submit proposed violations to FRA's Office of Chief Counsel, which reviews them for legal sufficiency. After review, similar violation reports by carriers are aggregated and submitted to the carriers under a penalty demand letter as a single case. After the carriers conduct their own investigations, FRA negotiates a settlement with the carriers. Generally, FRA settles with the carriers for about 50 to 60 percent of the initial assessments. In fiscal year 1987, FRA collected about $3.4 million in fines.

FRA field inspectors also investigate certain types of accidents. FRA has wide latitude in deciding which accidents to investigate; however, it generally investigates the following types:

- collisions or derailments resulting in death to employees, passengers, and/or the general public;
- a minor collision or derailment resulting in serious injury to several employees and/or passengers; and
- collisions or derailments with strong public interest, such as those involving hazardous materials.

FRA investigates accidents to identify the primary and contributing cause factors in order to determine whether any of these factors constitute noncompliance with its regulations. FRA inspectors observe the accident scene, interview crew members and witnesses, and review carrier-supplied information. After the investigation, a draft accident report

containing all the facts and the determined cause(s) is submitted to FRA headquarters by the cognizant regional director. FRA headquarters officials review the field accident reports for consistency and completeness and forward them to the FRA Safety Review Board. The Chairman reviews each accident report and makes a final determination of the cause.

The National Transportation Safety Board (NTSB), an independent federal agency, encourages safety by making nonbinding recommendations to FRA or the industry based upon its independent accident investigations and safety studies. NTSB has discretion over which accidents to investigate and bases that decision on the significance of the safety issue and availability of staff.

Individual carriers investigate all accidents in which their equipment or track is involved and may take corrective action whenever indicated by their own investigation or FRA enforcement actions. Carriers are required to report to FRA any accident resulting in death, in the injury of five or more people, or damages (to railroad property) of at least $5,200.

FRA maintains a data base of the information reported about accidents and incidents.[1] FRA officials told us they periodically review summary information from FRA's data base for several purposes, such as planning inspections and analyzing resource and policy needs. If they observe increasing trends in specific accident causes, FRA officials conduct research to determine the basic cause of the problem and possible solutions. When the research phase is completed, FRA disseminates information on the problem and the appropriate solution to the carriers in an attempt to achieve changes in operations through voluntary compliance. If the problem is not solved through voluntary compliance, FRA officials said they consider whether new safety standards are appropriate on the basis of the results of benefit-cost analyses, among other things.

Objectives, Scope, and Methodology

The objectives of this review were to (1) develop statistical profiles of railroad safety in Pennsylvania and the nation and (2) review FRA's investigation of railroad accidents over a 13-month period ending January 1988 to ascertain the cause of the accidents as determined by the investigations and what actions FRA took as a result.

[1] FRA defines an accident as a collision, derailment, or other event involving the operation of railroad on-track equipment that results in damages of at least $5,200. An incident is any event where a fatality or injury occurs but with dollar damages below $5,200.

Representatives Coyne and Gekas made similar requests, which we incorporated into our work.

We examined FRA's authorizing legislation and regulations to determine FRA's authority and safety policies. We interviewed headquarters and regional personnel at FRA to determine FRA's mission and programs in rail safety, particularly in regulation, accident investigations, and enforcement. We also determined the roles of AAR and NTSB in establishing rail safety standards and investigating accidents, respectively.

To develop the statistical profile of railroad safety in Pennsylvania, we used published FRA summary statistics for 1984 through 1986. To compile statistics for 1987, which were unpublished at the time of our review, we used FRA's on-line accident/incident data base. The source of FRA's data is the carriers. We did not independently verify the accuracy of the data nor trace their support to carrier records. However, we are examining the reliability of the data in a separate, ongoing review.

We reviewed FRA's files for the 21 accidents investigated in Pennsylvania during the period of January 1987 through January 1988. We interviewed FRA regional and headquarters officials to determine their process for investigating accidents, including cause determination, the application of FRA policies to enforcement, and other follow-up action. We also discussed the accidents and reviewed files at the railroads involved in the accidents:

- CSX Transportation, Baltimore, Maryland;
- Consolidated Rail Corporation (Conrail), Philadelphia, Pennsylvania;
- National Railroad Passenger Corporation (Amtrak), Washington, D.C., and Philadelphia, Pennsylvania;
- Southeastern Pennsylvania Transportation Authority (SEPTA), Philadelphia, Pennsylvania; and
- Pittsburgh and Lake Erie Railroad (P&LE), Pittsburgh, Pennsylvania.

During our review, two collisions occurred, and we observed the accident investigations in the field to determine how investigations are conducted. The accident investigations we observed involved Conrail in Thompsontown, Pennsylvania, and Amtrak in Chester, Pennsylvania.

Our audit work was conducted from November 1987 to October 1988 in accordance with generally accepted government auditing standards. We

discussed our findings and observations with FRA officials and incorporated their comments in this report as appropriate. As requested, we did not obtain official agency comments on a draft of this report.

Pennsylvania Train Accidents Decrease Overall, but Some Types of Accidents Increase

FRA compiles statistical data from reports that carriers submit about accidents and incidents. However, FRA does not require the carriers to report state-by-state rail operating data. Therefore, the states cannot be compared on the basis of their respective accident rates, for example, accidents per million train operating miles. We could not, therefore, develop valid comparisons of rail safety in Pennsylvania and the other states. In this chapter, we have instead summarized data on the total number of accidents and incidents in Pennsylvania and the nation for 1984 through 1987. Over this period, the data for both Pennsylvania and the nation show an overall decline in the number of accidents, incidents, and casualties; but the cost of damages to rail property increased between 1986 and 1987. The number of derailments, accidents involving hazardous materials releases, and rail/highway crossing accidents increased slightly in Pennsylvania between 1986 and 1987, but these types of accidents decreased nationally. However, it is not possible to confirm these changes in the number of accidents as gains or losses in rail safety in Pennsylvania without computing the accident rates for 1984 through 1987.

FRA Data Limitations Preclude Analysis of Rail Safety by State or by Region

FRA maintains accident and incident data reported by the railroads in a data base that it uses for public reports on rail safety and for its own internal analyses in support of program planning and regulatory activities. FRA's data base contains detailed information on the number and characteristics of accidents and incidents in the nation and by state.

We were unable to compare the relative level of rail safety in Pennsylvania with that in other states because state-specific data on train operations were not available. Train miles operated are an important measure of accident exposure. The rate of accidents per million train miles operated builds in an adjustment for different levels of exposure among carriers, states, or regions. For example, if train operations actually decreased significantly in Pennsylvania from 1984 to 1987, the gradual decline in numbers of accidents might be calculated as an increase in the accident rate. Conversely, the slight increase in the number of certain types of accidents in Pennsylvania between 1986 and 1987 could amount to a decrease in the rate of these accidents if train operations increased during the same period. States and regions also differ in topography, population density, number of rail/highway crossings, and other characteristics related to rail safety for which current data are not available. In view of this, train operations data by state and region potentially represent the only common element from which to

compute accident rates as a basis for valid trend and cross-state and -region comparisons.

FRA collects data on total train operations from each railroad and compares the rail carriers' safety records on the basis of each carrier's rate of accidents per million train miles operated. Since 1984 the national accident rate has decreased from 6.58 per million train miles to 4.55 per million train miles in 1987. Neither FRA nor AAR requires the railroads, whose operations are multistate, to report their total annual train miles by state or by FRA region. Without these data, we could not make valid comparisons of rail safety in Pennsylvania and other states, nor perform trend analyses for Pennsylvania in the appropriate fashion: comparisons of year-to-year accident rates. Accordingly, we have limited our discussion of the data to some overall observations about changes in the total annual number of accidents and incidents between 1984 and 1987 in Pennsylvania and the nation. For reference, we also include 1984-87 accident data and total system operating data in appendix II for the two main freight carriers operating in Pennsylvania.

The tables which follow summarize the total number of accidents and incidents during 1984-87 in Pennsylvania and the nation, by impact (casualties, damages, evacuations for hazardous materials releases) and type (derailments, collisions, highway crossings).

Accidents/Incidents and Casualties Decline, but Damages Rise

Table 2.1 profiles overall changes in the total number of accidents/incidents, fatalities/injuries, and damages between 1984 and 1987 as reported to FRA by the carriers. Pennsylvania generally participated in a national decrease in the number of accidents/incidents and casualties (fatalities and injuries). However, the total cost of damages to railroad property—FRA does not collect estimates of the cost of damages to cargo or cleanup of nonrailroad property—from accidents increased for both the nation and Pennsylvania between 1986 and 1987, and Pennsylvania's share of the national total increased.

Table 2.1: Pennsylvania's Accidents/ Incidents, Casualties, and Damages Compared With the Nation's

Dollars in thousands

	1984	1985	1986	1987
Total accidents/incidents				
Nation	12,246	10,848	9,168	8,816
Pennsylvania	486	359	314	307
Percent PA:US	4.0	3.3	3.4	3.5
Fatalities				
Nation	1,181	982	1,031	1,107
Pennsylvania	40	26	21	35
Percent PA:US	3.4	2.6	2.0	3.2
Injuries				
Nation	9,138	8,031	7,373	6,585
Pennsylvania	671	296	285	195
Percent PA:US	7.3	3.7	3.9	3.0
Total dollar damages[a]				
Nation	$240,463	$188,018	$167,549	$180,003
Pennsylvania	8,227	4,807	5,117	6,638
Percent PA:US	3.4	2.6	3.1	3.7

[a]The data base that includes dollar damages contains only accidents, not incidents. Figures for damages include costs for railroad property only and do not include freight or cleanup costs.

Upturn in Derailments

Table 2.2 shows the number of accidents by type (does not include incidents). Nearly 78 percent of the accidents in Pennsylvania (and 70 percent in the nation) in 1987 were derailments, primarily caused by track problems. The number of collisions in both Pennsylvania and the nation fell between 1986 and 1987. The national total of derailments and rail/highway crossing accidents also decreased between 1986 and 1987. However, both types of accidents increased slightly in Pennsylvania so that Pennsylvania's share of the nation's derailments and rail/highway crossing accidents in 1987 rose to 4.3 percent and 6.7 percent, respectively.

Table 2.2: Types of Accidents

	1984	1985	1986	1987
Derailments				
Nation	2,915	2,495	2,006	1,873
Pennsylvania	112	75	73	81
Percent PA:US	3.8	3.0	3.6	4.3
Collisions				
Nation	419	366	320	291
Pennsylvania	14	11	9	5
Percent PA:US	3.3	3.0	2.8	1.7
Crossing accidents				
Nation	188	155	141	134
Pennsylvania	9	4	5	9
Percent PA:US	4.8	2.6	3.5	6.7

Upturn in Hazardous Material-Related Accidents

Table 2.3 profiles key hazardous material data for Pennsylvania and the nation. The number of hazardous material-related accidents and number of people evacuated as a result declined nationally between 1986 and 1987, while they increased somewhat in Pennsylvania. Pennsylvania's share of the national total rose to 3.6 percent of all hazardous material accidents, 9.2 percent of all cars releasing hazardous material, and more than one-half of all those evacuated (largely as a result of one serious accident).

Table 2.3: Accidents Involving Hazardous Material (HM)

	1984	1985	1986	1987
Number of accidents				
Nation	443	431	370	360
Pennsylvania	28	11	6	13
Percent PA:US	6.3	2.6	1.6	3.6
Cars releasing HM				
Nation	100	109	79	87
Pennsylvania	3	2	2	8
Percent PA:US	3.0	1.8	2.5	9.2
Number evacuated				
Nation	4,446	11,879	39,701	23,495
Pennsylvania	150	300	10	12,360[a]
Percent PA:US	3.4	2.5	0.03	52.6

[a]FRA accident investigation reports showed 26,150 persons evacuated in four accidents.

Rising Highway Crossing Accidents and Incidents

Table 2.4 shows that the number of rail/highway crossing accidents and incidents decreased nationally but gradually increased in Pennsylvania since 1984. The number of injuries from such accidents has decreased; however, the number of rail/highway accident fatalities nationally and in Pennsylvania increased in 1987, bringing Pennsylvania's share of the national total to 2.4 percent. The table excludes private highway crossing accidents and incidents, for which data were not available.

Table 2.4: Accidents/Incidents and Casualties at Rail/Highway Crossings

	1984	1985	1986	1987
Accidents/incidents				
Nation	6,370	6,093	5,620	6,112
Pennsylvania	103	110	124	126
Percent PA:US	1.6	1.8	2.2	2.1
Fatalities				
Nation	543	480	507	552
Pennsylvania	9	4	9	13
Percent PA:US	1.7	0.8	1.8	2.4
Injuries				
Nation	2,597	2,395	2,227	2,205
Pennsylvania	41	43	38	33
Percent PA:US	1.6	1.8	1.7	1.5

Pennsylvania's increases in 1987 in the number of accident fatalities, derailments, crossing accidents, and accidents involving hazardous materials and related evacuations might suggest that the level of rail safety in Pennsylvania is declining. However, the patterns would have to be confirmed by examining accident rates, to adjust for concomitant changes in train operations in 1986 and 1987 in Pennsylvania and the nation. Unfortunately, this cannot be done because FRA does not collect state- or region-specific train operations data. For the same reason, FRA is limited to analyses of national accident rates, which obscure exceptions in individual regions or states, such as those in Pennsylvania for 1986-87. FRA officials told us that they believed that requiring the carriers to report their operations data by state and region would be too costly, but they did not offer any studies or analyses showing what the costs would be or that the cost of obtaining the data would outweigh the benefits of having the information available for FRA's use.

We believe there may be potential benefits in FRA's having the capability to analyze rail safety at state and regional levels, so that it could better target hazards and assign inspectors accordingly. As a first step FRA

could explore the costs and benefits of requiring the rail carriers to report the information.

Most Accidents Did Not Involve a Violation of FRA's Regulations

FRA enforced a violation of its regulations in one accident by assessing the maximum civil penalty—$2,500 at the time—against the responsible carrier, but determined that six accidents were of unknown cause or the result of vandalism. FRA's inspectors did determine 1 or more causes of the 14 remaining accidents, but did not follow up these accidents with enforcement action because (1) the cause factors were not specifically addressed by its regulations; (2) the cause factors were addressed by FRA's standards, but were within acceptable tolerances; or (3) the accident circumstances did not meet its enforcement rules. FRA officials told us they refrain from making rules or standards on any aspect of rail safety for which they believe the industry has already developed effective rules or standards. They stated that their enforcement rule is to assess civil penalties against carriers for every case of noncompliance with its regulations, except in instances involving its track standards, for which it requires evidence of a carrier's prior knowledge of noncompliance.

In this review of FRA's follow-up to the accidents in Pennsylvania from January 1987 to January 1988, we did not attempt to verify nationally (1) how FRA decides a specific industry rule is inadequate and whether it then establishes a federal rule or (2) whether FRA consistently assesses penalties in every case of noncompliance, including track cases where evidence of the carrier's prior knowledge of a defect has been established. Accordingly, we are not making recommendations; however, these broader issues will be the subject of other GAO reviews.

Most Accident Cause Factors Not Specifically Addressed by FRA Regulations

Of the 21 accidents FRA investigated in Pennsylvania between January 1987 and January 1988, it assessed a civil penalty following 1 accident, attributed 2 accidents to vandalism, and could not determine the cause of 4 accidents to its satisfaction.[1]

For the remaining 14 accidents, FRA inspectors did not cite violations of FRA safety standards because

- the primary and contributing cause factors were not addressed by FRA's regulations, although they were generally covered by industry, carrier, or state rules; or

[1]The accident causes identified in this report are those attributed by the FRA field inspectors, supplemented in some cases by the opinions of the carrier(s) or NTSB. FRA's final cause determinations were not available as of October 1988.

- the cause factors were addressed by FRA standards, but were within acceptable tolerances of the applicable standard; or
- the circumstances of the accidents did not meet FRA's rules for enforcement or it had insufficient evidence.

The FRA inspectors' accident investigation reports on the 21 Pennsylvania accidents illustrated significant impact: 11 deaths, 54 injuries, 26,150 people evacuated as a result of hazardous materials releases, and over $10.5 million in damage to railroad property. The majority of the accidents were derailments. Table 3.1 summarizes the 21 accidents and their impact. Detailed descriptions of each accident taken from the inspectors' reports are included in appendix I.

Table 3.1: Impact of 21 Accidents FRA Investigated in Pennsylvania, January 1987-January 1988

Location	Type	Fatalities	Injuries	Number evacuated	Damages
Confluence 5/06/87	Derailment/HM	1	•	950	$1,172,700
Bridgewater 1/30/88	Derailment	•	4	•	1,431,500
McKeesport 9/22/87	Derailment	•	1	•	33,450
Confluence 1/15/87	Derailment	•	•	•	254,500
McKeesport 8/22/87	Derailment/HM	•	•	700	175,000
Pittsburgh 8/05/87	Derailment	•	•	•	159,000
Torrance 8/06/87	Derailment	•	•	•	149,400
Annville 10/12/87	Crossing	2	2	•	500
Hatfield Township 3/11/87	Crossing	1	3	•	44,427
West Decatur 7/15/87	Crossing	3	1	•	300
Chester 1/29/88	Collision	•	31	•	3,380,000
Thompsontown 1/4/88	Collision	4	2	•	1,649,500
Beaver Falls 3/25/87	Derailment	•	•	•	252,000
Chambersburg 9/23/87	Derailment	•	•	•	211,440
Confluence 6/28/87	Derailment	•	•	•	161,950
Connellsville 7/28/87	Derailment	•	•	•	74,460
Morrisville 2/9/87	Derailment/HM	•	3	2,500	197,737
Norristown 1/12/88	Collision	•	7	•	204,400
Pittsburgh 4/11/87	Derailment/HM	•	•	22,000	653,328
Philadelphia 1/14/87	Derailment	•	•	•	58,700
Rasselas 9/29/87	Derailment	•	•	•	281,200
Total (21)		**11**	**54**	**26,150**	**$10,545,492**

Note: These data are taken from FRA inspectors' accident investigation reports.

FRA Took Enforcement Action Following One Accident

Following a May 6, 1987, derailment and hazardous materials release in Confluence, Pennsylvania, FRA cited CSX for a violation of federal track standards. FRA imposed the maximum fine of $2,500, after establishing that CSX had previous knowledge of a track condition that did not comply with federal standards, but had failed to repair it. This accident was also attributed by FRA and NTSB to mismatched wheels—not addressed by FRA's regulations—on 1 of the 22 derailed hazardous materials cars. This car had derailed on three occasions within the previous 9 months. The NTSB investigation report noted that CSX had also violated an FRA standard by not properly inspecting the car. However, FRA did not cite CSX because it believed this particular defect was not readily apparent in the visual inspection required by its standards.

FRA Could Not Determine the Cause of Four Accidents

FRA officials told us they could not establish the cause of four accidents in Pennsylvania[2] and therefore could not determine whether its safety standards had been violated.

At a January 1987 derailment in Confluence, FRA found that one of the rails around a curve was extremely worn. Although the track was destroyed, FRA found wide gauge spots in nearby track (within allowable variances) but could not attribute the accident to track problems. CSX officials believed that track irregularities caused the derailment, but because FRA field inspectors could not definitively determine that track problems caused the accident, the cause was classified as unknown.

In August 1987, an Amtrak passenger train bound for Washington, D.C., derailed on CSX track within Pittsburgh city limits. No one was injured, and damage to railroad property amounted to $159,000. The third of 3 locomotives and 14 following cars derailed when the outside rail on a curve overturned. FRA's accident investigation report stated that there was a change in the alignment of the track in the area of the derailment—within FRA's allowable variances—but this could not be attributed as the cause of the accident. FRA concluded that the cause of the accident was unknown.

Derailments in Torrance and McKeesport were attributed by FRA field inspectors to overheated wheel-bearing journals that failed. The journal is a lubricated bearing for car axles (usually found in older cars), which support the car's weight. The Torrance derailment caused $149,400

[2]FRA believed that, in addition to these four accidents, two were caused by vandalism and no federal standard was violated.

worth of damage to railroad property; the McKeesport derailment caused $175,000 in damage, and 700 people were evacuated because of a hazardous material release. FRA headquarters officials stated that because a determination could not be made about what caused the wheel-bearing journals to overheat, the cause of these accidents is unknown. FRA has standards covering the maintenance and condition of wheel-bearing journals, but it believed that the carriers' predeparture inspections of the journals would not necessarily have detected a condition that led to overheating, according to FRA officials. Since its inspectors could not determine what type of condition caused the overheating, FRA could not know whether its standards had been violated and therefore did not cite a violation. After the McKeesport accident, CSX employees told FRA inspectors that they had not conducted a predeparture inspection of the journal boxes, as required by FRA, but would not sign a statement to that effect. According to CSX officials, FRA never raised the issue with them.

Several Accidents Caused by Factors Addressed by Industry Rules, but Not in FRA's Regulations

Five of the accidents investigated by FRA were determined to be caused by factors that were addressed wholly or in part by industry rules, but not by FRA's regulations. These accidents included rail/highway crossing accidents and accidents caused by operational errors made by railroad employees—"human factor" causes. Of the 5 accidents, there were 3 crossing accidents and 2 collisions that resulted in 10 fatalities, 39 injuries, and nearly $5.1 million in property damage.

In the three rail/highway crossing accidents that involved six fatalities and five injuries, FRA determined the cause to be the motor vehicle driver's failure to yield to a train. The rail industry has established rules for maintaining signs, signals, gates, and visibility at rail highway crossings. Signals were present at two of these accidents and proved to be in working order.

Local and state governments establish laws prescribing the extent of protection at public highway crossings, and the states' motor vehicle codes regulate motorists at crossings. Federal funding for upgrading crossings is available through the Federal Highway Administration. The Pennsylvania Motor Vehicle Code requires private vehicles to yield to an approaching train. The code, however, does not require a private vehicle to "stop, look, and listen" at a crossing. FRA had not addressed any rail/highway crossing aspects in its regulations; however, the 1988 Rail Safety Act addresses grade crossing safety by (1) requiring FRA to establish certain demonstration projects for the purpose of evaluating

whether various specific measures would reduce accidents; (2) authorizing $1 million for improvements in grade crossing safety; and (3) requiring the Secretary, Department of Transportation (DOT), to issue such rules, regulations, orders, and standards as may be needed to ensure the safe maintenance, inspection, and testing of signal systems and devices at railroad highway grade crossings.

Collisions in Thompsontown and Chester involving 4 fatalities, 33 injuries, and $5 million in property damage were both attributed to human factors, meaning the behavior of railroad employee(s) directly caused the accident. Nationally the rate of human-factor-caused accidents is second only to the rate of track-caused accidents.

In Thompsontown, one of the two trains ran through a stop signal and a switch, and in Chester a tower operator failed to throw a switch before displaying a proceed signal to an Amtrak passenger train.

FRA officials acknowledged that FRA has had the authority to establish operating rules and to assess penalties against the carriers for instances of operating errors by individual employees. However, they told us that FRA has chosen not to duplicate effective operating rules of the industry. The industry's operating rules, supplemented by those of individual carriers, are enforced at the discretion of each carrier, which may take disciplinary action against an individual employee who violates industry or carrier rules.

FRA has only recently obtained the authority to penalize individual rail employees. At FRA's request, the Congress provided FRA, through the 1988 Rail Safety Act, the authority to directly assess penalties against individual rail employees who willfully violate any FRA rule or standard.

Track Irregularities That Caused Accidents Were Within Range Tolerated by FRA's Track Standards

On the basis of our review of FRA field inspectors' reports, six accidents were wholly or in part attributed to track irregularities. However, the specific irregularities were within a range of deviation tolerated by the applicable FRA standard, so no violation occurred. These accidents resulted in 10 injuries, $1.1 million in damage to railroad property, and the evacuation of 2,500 people because of a hazardous materials release.

FRA has established maintenance and condition standards for each of six classes of track and set maximum speed limits for each class of track. Table 3.2 summarizes FRA's speed limits for freight and passenger trains operating on each class of track.

Table 3.2: Maximum Speed, by Class of Track

Class of	Maximum speed (in miles per hour) Freight	Passenger
1	10	15
2	25	30
3	40	60
4	60	80
5	80	90
6	110	110

FRA's track standards tolerate different ranges of variance according to the class of track. For example, on straight track, alignment may not vary more than 1/2 inch over 62 feet for the highest class of track—class 6. For the lowest class—class 1—a 5-inch deviation is allowed. FRA headquarters officials pointed out that tightening the track standards is difficult, not only because of the cost to the carriers, but also because of the feasibility of developing an efficient method for inspecting track against a narrower range of tolerance.

Derailments are often caused by a combination of factors. For example, derailments may occur because of track defects in combination with one or more operating errors. Such errors could include improper loading of certain types of cars or traveling at a speed inappropriate for the conditions. FRA inspectors attempt to determine whether any of the contributing cause factors constitute noncompliance with the federal regulations. The following are some examples of this type of derailment among the Pennsylvania accidents.

In March 1987, 17 cars—including a hazardous material car—rocked off the track as the train rounded a curve at Beaver Falls, Pennsylvania, causing $252,000 in damage to railroad property. The track irregularity cited as one of the causes of the accident was in compliance with FRA's track standards because it was determined to be within the allowed range of deviation.

Similarly, an irregular track surface—in combination with a curve and operation of the train within the critical speed range that would allow a car to rock and lift a wheel off the track—caused a derailment at Confluence, Pennsylvania, in June 1987. Carriers set certain ranges of speed, known as "critical speed" (usually in the range of 10-25 mph) that can trigger harmonic rocking of the cars on certain stretches of track. The specific track irregularity cited as a contributing cause was in

compliance with the range of deviation allowed by FRA's track standards. Thirteen cars derailed, causing nearly $162,000 in damage.

Minor variations permitted by FRA's track standards caused a July 1987 derailment at Connellsville, Pennsylvania, according to the carrier. The train contained 4 hazardous material cars, 2 of which were among the 17 cars derailed. Residue liquid propane gas and residue hydrogen sulfide did not escape from the derailed cars, nor was there an evacuation. The accident caused over $74,000 in damage. FRA's inspectors cited improper loading of a car (which FRA does not regulate) as the primary cause of this accident, with track irregularities as a contributing cause.

According to FRA officials, the research and development program is one of the ways it also follows up on accidents resulting from common problems. According to FRA officials, they have several research efforts underway relating to track geometry problems. They described, as an example, an ongoing study of factors that cause certain stretches of track to buckle or kink in extreme heat. FRA's research to date has found this happened most often to those portions of track that had recently been subjected to maintenance procedures. FRA officials said that their researchers then proceeded to develop a new approach to maintenance that did not leave the track vulnerable to extreme temperatures. FRA has since been conducting educational sessions with each of the carriers in a attempt to persuade them to voluntarily employ the new maintenance procedures. They also stated that research is underway on track-train dynamics, that is, the effect that the placement of various types of loaded and unloaded cars within a train has on train handling.

Circumstances of Three Accidents Lacked Basis for Enforcement Under FRA Rules

FRA did not follow up on three accidents with enforcement either because it lacked sufficient evidence of the carrier's prior knowledge of a track defect that caused the accident or because it generally expects the carriers to enforce violations of FRA's or the carriers' speed standards. These accidents resulted in the evacuation of 22,000 people and $993,000 in damage to railroad property.

The most serious of the accidents was a derailment that occurred in Pittsburgh and resulted in a hazardous material release and evacuation. Both FRA and NTSB determined the derailment was caused by improper train handling, including a speed of 60 mph in a 30 mph zone on a curved, descending track. However, under its enforcement policy, FRA officials told us, FRA does not generally cite a carrier for a single violation of its maximum speed limit by a carrier employee, since FRA expects

that the carrier will take disciplinary action against its employee. They said FRA does assess penalties against carriers when its inspectors detect consistent violations of its speed limit for a given class of track—the result of spot checking by FRA's inspectors using radar guns. In such cases, FRA cites the carrier for violating the maintenance standards, rather than the maximum speed, it established for the class of track, consistent with its decision not to cite the carriers for speed violations.

A second derailment, in Philadelphia, was attributed to a defective switchpoint. The carrier had identified the defect 2 days before the accident. However, FRA field inspectors did not cite the carrier for a violation, because FRA policy generally allows the carrier 30 days in which to correct track defects, and the accident occurred before 30 days had elapsed.

FRA field inspectors attributed a derailment in Rasselas to a split rail—a violation of FRA track standards. In this case, Conrail had conducted a rail flaw inspection 6 months earlier and a routine visual inspection 4 days before the accident. However, FRA could not produce evidence that the rail was split at the time of the carrier's inspections, nor that the split rail could have been detected by the type of inspections conducted by the carrier. Therefore, FRA could not establish that the carrier knew about the split rail before the accident, which its enforcement policy requires in order to cite a carrier with a violation of its track standards. According to FRA officials, they are conducting research into the adequacy of its standards for the frequency and type of track inspection.

Summary

Most of the factors that caused the accidents FRA investigated in Pennsylvania between January 1987 and January 1988 either were not addressed or were within a range of tolerance set by its regulations, leaving no basis for federal enforcement except in one case. Many of the other accident causes were subject to industry self-enforcement; that is, involved carriers could discipline their employees for violations of applicable industry or carrier rules. FRA's research and development activities are addressing some of the factors common to these accidents—an additional form of follow-up to rail accidents.

The effectiveness of FRA's regulatory and enforcement approach cannot be assessed on the basis of its follow-up on these accidents in Pennsylvania. The effects of FRA's regulatory and enforcement policies in terms of how well its national inspection and enforcement programs are working will be the subject of future GAO reviews.

Accident Summaries

Summary of Confluence Derailment on May 6, 1987

On May 6, 1987, at 4:20 a.m., 28 cars of a 116-car CSX freight train derailed in Confluence, Pennsylvania. The derailment destroyed a control tower and killed the operator inside. There were no other casualties. Twenty-one derailed cars contained residue hazardous materials; one released hydrochloric acid fumes and another released a small amount of caustic soda. Between 900 and 1,000 people evacuated their homes for over 12 hours. CSX estimated the damage to track, structures, signals, and equipment at $1,172,700. The fireman was operating the train.

The cause of the accident was a combination of two main factors: 1) a tank car with residue propane flammable gas had mismatched truck sides, which caused the wheels to skew and overclimb the rail, and 2) a track geometry defect. The same car derailed on three previous occasions: March 1987, October 1986, and August 1986. Records of the Confluence accident do not indicate the circumstances of the other derailments. ACF Industries, the car owner, repaired the 1963 vintage car in February 1986 and after each derailment. ACF scrapped the car after the Confluence accident. There are no federal regulations governing mismatched wheel truck sides, and they are not normally inspectable except during overhaul or repair work. A CSX track geometry car found the track defect on April 7, 1987, but CSX had not corrected the problem. A CSX employee visually inspected the track, saw no problem, and did not order repairs.

FRA and NTSB conducted field investigations of the accident. Both agencies and CSX agreed that the primary cause was the mismatched truck sides on the tank car. FRA and CSX also agreed on the track problem as a contributory cause. FRA cited CSX for a track violation, and CSX paid the $2,500 maximum fine. Although NTSB believed that CSX also violated federal regulation by not properly conducting a car inspection, FRA did not cite CSX because the mismatched truck sides were not readily apparent in a visual inspection. Lastly, NTSB noted that two of the derailed hazardous material cars did not have placards to designate them as carrying residual hazardous material—isobutane and liquid propane gas. This also did not result in a violation because FRA could not ascertain whether emergency personnel removed the placards for information about the hazardous materials or whether the placards had come off in the derailment.

Summary of Bridgewater Derailment on January 30, 1988

On January 30, 1988, at 2:20 p.m., four employees were injured when a CSX freight train with two locomotives hit a boxcar on a siding and derailed. Both locomotives fell on their sides, and 11 following cars derailed. The derailed cars carried auto parts or auto racks; one was an empty gondola. The entire train consisted of 101 cars and 2 locomotives. CSX reported total damages of $1,431,500.

After passing a clear signal, the train crew saw a youth waving his arms. Next, they saw two other youths stoop over the switch for an industrial siding; then, both youths ran over the embankment. The switch sent the train into the siding, where it struck a boxcar. FRA found vandalism to be the cause of the accident. The hand-thrown switch was found to be unlocked. According to Pittsburgh and Lake Erie (P&LE) officials, switch keys are widely available, e.g., in flea markets. After the accident P&LE installed a tamper-proof lock on that switch.

Summary of Mckeesport Derailment on September 22, 1987

On September 22, 1987, at 12:12 a.m., an Amtrak passenger train on Pittsburgh and Lake Erie (P&LE) track near McKeesport, Pennsylvania, struck a rerail device that had been placed on the track, and the train derailed. No passenger casualties resulted from the derailment. The engineer injured his back and lost 13 days of work time. Total damages were reported to be $33,450. FRA, Amtrak and P&LE all agreed that the primary cause was an object fouling the track. Both carriers named vandalism as a contributing cause of the accident.

Summary of Confluence Derailment on January 15, 1987

On January 15, 1987, at 4:40 p.m., 28 cars of a 76-car CSX freight train derailed in Confluence, Pennsylvania. The train was being operated by the fireman. There were no casualties. Although there were some hazardous material cars on the train, none derailed or were damaged. CSX estimated the damage to equipment, track, and signals at $254,500.

FRA was unable to determine a cause. One rail was curve-worn, but the gauge did not exceed federal standards. Although wide gauge spots existed in the track, FRA could not attribute the accident to track problems. No violations resulted from the accident investigation.

One problem disclosed in the investigation was that the crew said it initially did not know the train had any hazardous material cars because none were shown on the consist (listing of cars in the train). The crew eventually found waybills for three hazardous material cars stuffed behind the emergency brake valve in the locomotive. FRA did not cite

CSX for a violation because, technically, documentation on the hazardous material cars was on the train.

In its report to FRA, CSX cited "other rail and joint bar defects" as the primary cause of the derailment. No additional specifics regarding the cause were available from CSX because the file could not be located.

Summary of Mckeesport Derailment on August 22, 1987

On August 22, 1987, at 12:18 p.m., 16 cars of a 37-car CSX freight train derailed on Pittsburgh and Lake Erie (P&LE) track in McKeesport (Port Vue), Pennsylvania. Four hazardous material cars derailed and were damaged. The hazardous materials involved were liquid caustic soda, butane, and hydrochloric acid (two cars). About one-fourth cup of caustic soda escaped from one tank but was contained in a safety vent closure cap and did not reach the ground. McKeesport police evacuated up to 700 people for 24 hours until the butane car was rerailed. CSX estimated the damage to equipment and track at $175,000. There were no casualties.

FRA found that the derailment occurred because of excessive heat on the plain-bearing journal of the eighth car, which allowed the truck (wheel) side frame to drop to the track. A journal is a lubricated bearing for car axles that supports the car's weight. Also, FRA found that a P&LE heat sensing hot box detector along the track, used to detect overheated journals, had a broken mirror and was not functional. However, FRA and P&LE agreed that the detector was so close to the derailment site that it could not have identified the hot journal in time to prevent the accident. Apparently the journal began overheating sometime after the previous detector on CSX track 31 miles away. FRA officials stated that FRA does not regulate the placement and maintenance of hot box detectors. CSX did not maintain an accident file because the derailment occurred on P&LE track, and P&LE was responsible for coordinating the carrier investigation. However, P&LE does not maintain accident files. Both carriers reported the accident to FRA and stated the cause as journal failure from overheating.

Although CSX employees told FRA that they did not conduct a federally required predeparture inspection of the journal boxes, FRA did not cite CSX for a violation because FRA did not observe the violation and the employees refused to sign a statement. CSX said that FRA never raised the issue with them.

Summary of Pittsburgh Derailment on August 5, 1987

On August 5, 1987, at 8:58 a.m., an Amtrak passenger train derailed within Pittsburgh's city limits on CSX track. The third of 3 locomotives and 14 following cars derailed as a result of the outside (high) rail's rolling over. The derailed locomotive and cars all remained in line and upright. No casualties occurred. Damage to railroad property was $159,000.

Amtrak reported the cause as irregular track alignment. Amtrak's accident report noted that the combination of cross-level deviation and change in alignment resulted in the overturning of the north (outside) rail on a curve. Amtrak's measurements were very close to those made by FRA, and both met FRA standards. The FRA accident investigation report commented that the change in alignment in the area of derailment, though "not a desirable condition, is within the prescribed limits for FRA Class 3 track." FRA concluded that the cause of the accident was undetermined. No violations resulted.

Summary of Torrence Derailment on August 6, 1987

On August 6, 1987, at 3:30 a.m., 20 cars of a 116-car Conrail freight train derailed near Torrence, Pennsylvania. Four hazardous material cars derailed and were damaged, but no hazardous material was released, and no evacuation occurred. There were no casualties. Damage to property was estimated at $149,400.

The cause of the accident was a failed journal from excessive heat. A contributing cause was the failure of the conductor to detect the overheated journal, after a wayside radio alarm hot box detector indicated a hot journal on the twenty-third car in the train. An additional contributing cause was an unevenly distributed and shifted load in the twenty-third car. No violations resulted from FRA's investigation.

The carrier agreed that the cause of the accident was a journal failure from overheating. If a radio alarm detector identifies a warning, Conrail's operating rules require the train to be stopped and the defective car tested. If the defect is not found at the location specified, the conductor must inspect the four cars ahead and behind that car. Conrail believed the conductor miscounted the cars and thus did not test the appropriate car.

Summary of Annville Grade Crossing Accident on October 12, 1987

On October 12, 1987, at 11:40 a.m., the lead locomotive in a two-locomotive train struck a car at a private rail/highway grade crossing in Annville, Pennsylvania, killing two occupants and injuring two others. The crossing was marked with a foot-high "Private Crossing" sign. Damage to railroad property was estimated at $500.

FRA identified the primary cause as failure of the vehicle driver to stop the vehicle short of the railroad tracks when a train was in close proximity to the crossing. FRA monitored this crossing after the accident for traffic volume and found it had 56 cars and 2 trucks in a 24 hour-period. A private grade crossing is defined as roadways not open to use by the public, nor maintained by a public authority. This particular crossing was under a 5-year contract between the land owner and Conrail, but the contract began in 1981 and had expired when the accident occurred.

Summary of Hatfield Township Crossing Accident on March 11, 1987

On March 11, 1987, at 12:16 p.m., a Southeastern Pennsylvania Transportation Authority (SEPTA) commuter train struck a pickup truck at a grade crossing in Hatfield Township near Lansdale, Pennsylvania. The train was operating at an estimated 20 mph; witnesses said that the train was blowing its horn and at the crossing the warning lights were flashing red. Westbound traffic was stopped at the crossing. Nevertheless the truck, eastbound at about 30 mph, did not slow down or stop for the crossing.

One passenger in the truck was killed. The driver and the other passenger were seriously injured. One passenger on the train was slightly injured. The accident caused $44,427 in damage to railroad property.

The probable cause of the crash was the vehicle driver's failure to stop at the crossing. He said that the sun was in his eyes making it hard to see the warning lights. The Hatfield Township Police, who filed extensive investigative reports, charged the driver with vehicular homicide.

Summary of West Decatur Grade Crossing Accident on July 25, 1987

On July 15, 1987, at 8:45 a.m., a Conrail freight train collided with a pickup truck at a rail-highway grade crossing, killing the three truck occupants. The empty freight train approached the crossing at a speed of 12 mph on an industrial track, with the engine bell ringing, headlights on, and horn sounding. The crossing is marked by cross-buck signs. When the truck failed to stop, the engineer made an emergency brake application. The locomotive struck the truck, and the truck burst into

flames. One railroad employee attempted to put out the fire and was slightly injured. The locomotive sustained $300 damage.

The FRA reported the cause of the accident as failure to comply with the Pennsylvania Motor Vehicle Code, which requires a driver approaching a grade crossing to stop if (1) an approaching train emits an audible signal and by its nearness to the crossing is an immediate hazard or (2) an approaching train is visible and is in hazardous proximity to the crossing.

FRA's report noted that brush, approximately 8-1/2-feet high, ob ructed the train's view of the crossing; however, the Conrail rail-highway grade crossing accident/incident report indicated the motorist's view was not obstructed. The railroad is responsible for maintaining the vegetation on the railroad right-of-way.

Summary of Chester Accident on January 29, 1988

On January 29, 1988, at 12:34 a.m., a Washington-to-Boston Amtrak passenger train derailed after colliding with a maintenance vehicle (ballast regulator) at Chester, Pennsylvania. The two workers on the ballast regulator jumped to safety. The two locomotives were destroyed, as was the ballast regulator. Nine out of 10 passenger cars derailed but remained upright. Twenty-five passengers and 6 railroad employees were injured. Amtrak reported damages totaling $3,380,000.

The ballast regulator was on a track that had been taken out of service by the dispatcher. However, the train traveling north on the track received a signal to proceed, as a result of a mistake by the tower operator who controlled the automatic block signal system.

FRA indicated that the primary cause of the accident was that the tower operator misrouted the train. FRA noted the following as factors that could have contributed to the tower operator's error:

- He did not copy previous information about train movements as required.
- He routinely removed devices that blocked out sections of track without asking the dispatcher for approval. He usually contacted the dispatcher after the removal.
- He did not contact the dispatcher as required by Amtrak to verify train orders etc., and the dispatcher did not verify with the tower operator that he had all the train orders when the dispatcher came on duty. The

tower operator should have read the orders aloud to the operator of the previous shift at the shift change.

- The dispatcher did not take exception to the tower operator's having removed the blocking device on the switch without permission.

In addition, three maintenance men were in the tower when the operator made his error, and he later complained he was distracted. The tower operator left the tower right after the accident; he reappeared with an attorney on February 1.

All Amtrak employees involved in the accident were tested for drugs and alcohol. However, the tower operator who was absent without leave could not be tested until the evening of February 1, because of his disappearance until then. All tested negative except the tower operator and an assistant conductor. The tower operator resigned.

Summary of Thompsontown Collision on January 14, 1988

At approximately 7:55 a.m. on January 14, 1988, in Thompsontown, Pennsylvania, two Conrail freight trains collided head on. An eastbound coal train with 2 locomotives and 105 loaded cars disregarded a stop signal, ran through a switch, and collided head-on with a westbound merchandise train with 3 locomotives and 61 truck trailers and containers on flatcars. As a result of the collision, four crew members were killed and two were injured. Five locomotives, 30 hopper cars, and 2 flatcars with 4 trailers were destroyed. Conrail estimated damage to track, structures, signals, and equipment at $1,649,500. NTSB estimated damages at $2,032,400 for equipment only.

FRA determined the primary cause as failure of the coal train crew to stop the train, as required by signal indications. NTSB had not issued its official probable cause determination at the time we completed our field work, but NTSB officials believe that the coal train crew fell asleep, reflexively responded to the Automatic Train Stop (ATS),[1] and continued to travel until impact. There was no way to determine if the ATS on the coal train malfunctioned. On the basis of its investigation, the NTSB's Vehicle Factors Group believed that the ATS system was turned on prior to the accident. Post accident studies of the ATS could not reproduce a failure of the ATS from frozen pipes or valves. ATS test results supported the opinion that the ATS was operative and the engineer reflexively

[1]The Automatic Train Stop is designed to stop the train in the event the engineer fails to respond to a more restrictive signal. On Conrail trains, a whistle sounds when the signal changes to a more restricted aspect, and the engineer has 8 seconds to respond by pressing the floor acknowledgement pedal, or the ATS will stop the train.

responded to the alarm so the ATS did not stop the train. The coal train crew failed to respond to 2 radio alarm detectors located 19 and 5 miles before the collision point.

Conrail officials were reluctant to accept that the crew fell asleep and then defeated a safety device while asleep but had no other explanation for the accident cause. Uncertainty about the probable cause prevents Conrail from taking preventive action. One of the surviving conductors tested positive for marijuana. He was dismissed for his part in the accident, as well as the positive test, but had appealed the decision. At the time of our review, the appeal was still undetermined.

NTSB conducted a major investigation, with FRA, Conrail, and the Brotherhood of Locomotive Engineers as parties to the investigation. FRA found no violation as a result of the accident.

NTSB's public hearing on the accident disclosed problems with the dispatching computer system. The system was not designed to show the type of situation that occurred in Thompsontown, i.e., that a train entered a block of track occupied by another train. Also, the system sometimes "leapfrogged" the positions of trains on the dispatcher's display. No federal standards exist for computer-assisted dispatching systems.

Summary of Beaver Falls Derailment on March 25, 1987

On March 25, 1987, at 4:10 a.m., 17 cars of a 103-car CSX mixed freight train derailed at College, Pennsylvania, near Beaver Falls. On a curve the seventy-fifth car, a loaded auto rack, rocked off the track. Of the total of 17 cars derailed, 9 cars (including 8 auto racks) were on their sides and 8 remained upright. One car containing coal tar distillate, a hazardous material, derailed but remained upright with no damage to the tank. No casualties occurred. Damage to railroad property was estimated at $252,000.

FRA described the cause of the derailment as a combination of irregular cross level and soft roadbed which allowed a loaded auto rack to rock off on curved track. Pittsburgh and Lake Erie (P&LE) attributed the accident to a combination of a track geometry irregularity (cross level of track irregular—not at joints) and a soft spot in the roadbed. P&LE had inspected the track 2 days before the accident and had noted variations in the cross level, which were acceptable according to FRA standards. FRA did not find any violations related to the accident.

However, P&LE officers told us that they had disagreed among themselves about the cause of the derailment and believed that because 2 locomotives and 74 cars had safely passed the point of derailment before the seventy-fifth car derailed, track and roadbed could not be the sole cause of the accident. P&LE officers believe that they could not determine the cause of the accident.

Summary of Chambersburg Derailment on September 23, 1987

On September 23, 1987, at 5:36 p.m., 17 cars of an 81-car CSX mixed freight train (high-cube covered hopper cars, mixed freight cars, and loaded coal hoppers) derailed in Chambersburg, Pennsylvania. No casualties occurred, and the train was not carrying hazardous materials. CSX estimated the damages to equipment, track, and signals at $211,440.

FRA and CSX did not agree on the cause of the accident, and the difference has not been resolved. FRA blamed the engineer for exceeding the authorized 15 mph speed limit by 6 mph, which resulted in harmonic rock-off of one wheel on the fifth car (i.e., the swaying motion lifted the wheel off the track) as the train went through a curve. FRA stated that loaded, high center-of-gravity, covered hopper cars may also have been a factor in the accident. CSX timetable equipment restrictions for the section of track in question state that trains handling loaded, high-cube, 3,800 to 4,800 cubic feet, covered hoppers of 95-ton or greater capacity will avoid operation in the speed range of 14 to 21 mph. If speed cannot be maintained at or above 22 mph, the speed of the train must be reduced to below 14 mph. FRA pointed out that a track irregularity within allowable standards may have contributed to the accident.

CSX, on the other hand, stated that journal failure caused the derailment. A CSX official stated that FRA did not challenge CSX' determination of cause. CSX suspended members of the crew for failing to watch the train as it rounded curves as required by CSX' operating rules. The suspensions were withheld unless further disciplinary action occurred within the next 6 months against the employees.

FRA did not cite CSX for a violation because FRA has no regulations on the operation of high center-of-gravity cars in the critical speed range. Also, FRA enforces track maintenance standards not speed limits.

Summary of Confluence Derailment on June 28, 1987

On June 28, 1987, at 9:30 a.m., 13 cars of a 115-car CSX freight train derailed in Confluence, Pennsylvania. No hazardous material cars were involved. There were no casualties. CSX estimated the damage to equipment, track, and signals at $161,950.

FRA's investigation determined the probable cause to be harmonic lift-off of the lead wheel of the fifty-fourth car, an empty boxcar, due to an irregular track surface as the train rounded a curve at the critical speed of 25 mph (authorized speed was 30 mph). When the wheel hit a switch 4 miles down the track, the general derailment occurred. CSX, in determining the cause to be track geometry irregularities, basically concurred with FRA but did not relate speed to the accident. Its records show actual speed to have been 30 mph, which is beyond the critical speed for a harmonic lift-off of the wheel. A CSX track geometry car had inspected the area 5 months earlier but found no defects. Because the track irregularity did not exceed federal standards, FRA did not cite CSX for a violation.

Summary of Connellsville Derailment on July 28, 1987

On July 28, 1987, at 6:00 p.m., 17 cars of a 98-car CSX freight train derailed in Connellsville, Pennsylvania. Two hazardous material cars out of four in the train were derailed and damaged. No release occurred of the residue liquid propane gas or residue chlorine (the other two cars carried residue liquid propane gas and residue hydrogen sulfide), nor did an evacuation take place. There were no casualties. CSX estimated the damage to equipment, signals, and track at $74,460.

FRA and CSX did not completely agree on all factors that might have caused the derailment. FRA blamed uneven distribution of granulated limestone in a hopper car, in conjunction with a sudden change in track alignment, causing the wheel of the car to lift off the track at the critical speed range of 18-24 mph. The track irregularity did not exceed federal standards. CSX did not agree that the hopper car was improperly loaded or had any role in the accident. Rather, CSX stated the cause as rock-off due to minor track variations while the train negotiated a curve at the critical speed range. Although in November 1987 FRA directed its inspectors to address differences between their findings and the carrier's, there was no resolution of the difference in conclusions. CSX said that FRA did not discuss the difference in primary cause with them.

The FRA report indicated that CSX had conducted a track inspection 4 days before the accident and a rail flaw inspection about 4 weeks before the accident. No defects were noted. Because FRA does not regulate car

loading and the track irregularity did not exceed federal standards, no violations resulted from the accident investigation.

Summary of Morrisville Accident on February 9, 1987

On February 6, 1987, at 6:40 a.m. at Conrail's Morrisville Yard during a snowstorm, two hazardous material cars containing white phosphorus were coupled by gravity onto a track occupied by other tank cars. The couplers by-passed, resulting in the hazardous material car being punctured; the escaping white phosphorus ignited. The fire destroyed three tank cars, caused damage to adjacent equipment and track, and required extensive cleanup of contaminated soil. Approximately 2,500 people were evacuated for over 5 hours.[2] Three nonrailroad personnel claimed injury as a result of smoke inhalation. Conrail estimated damage to equipment and track at $197,737 plus environmental cleanup and property damage at $900,000. Cleanup took approximately 4 months to complete.

FRA's accident investigation concluded that the primary cause was by-passed couplers during gravity coupling operations. FRA surmised that the couplers did not connect, slid past each other, and the one coupler punctured the car containing white phosphorus. Regulations do not prohibit the gravity coupling of cars containing white phosphorous. Therefore, no violations resulted.

Conrail reported the probable cause was improper manual operation of the retarder. According to a Conrail official, the retarder operator's job is to control the speed of gravity-coupled cars, and the coupler could puncture the other car only if it was moving too fast. Although FRA examined the car retarder and found it working properly, it did not make the judgment that the retarder operator was at fault.

Summary of Norristown Collision on January 12, 1988

On January 12, 1988, at 1:40 p.m., a runaway covered hopper car struck a northbound SEPTA commuter train en route from Philadelphia to Norristown. The hopper car had rolled free from an industrial siding approximately one-quarter mile beyond a SEPTA station, running through a derail device on the siding and then through two switches onto SEPTA's Norristown single main track. Damage estimates were $204,400. Seven passengers were slightly injured; no crew members were injured.

[2]Conrail reported 1,500 people.

FRA reported that the primary cause of the accident was improper handling of equipment by a Conrail mechanic, who failed to adequately secure the wheels of the stationary hopper car. FRA also identified as a contributing cause the failure of the derail device, which could have failed because Conrail had not replaced a damaged piece, rendering the device incapable of sustaining the impact of the car. Conrail disagreed and stated the derail was not damaged.

A Conrail official stated that the industrial siding owner and Conrail were debating as to who was responsible for maintaining this derail. However, from the investigation it was not clear whether the device had failed because of lack of maintenance or from the impact of the car. Because of these uncertainties, FRA did not cite Conrail with a violation for not maintaining the derail device.

As a result of the accident, however, Conrail took the following corrective actions: (1) installed additional derails at the top of the incline at the industrial siding and before the siding joins SEPTA's main track and (2) checked SEPTA's main track for similar sidings and scheduled derails for installation as necessary.

Summary of Pittsburgh Derailment on April 11, 1987

On April 11, 1987, at 12:29 p.m., a westbound Conrail freight train derailed and sideswiped an eastbound Conrail freight train. A total of 33 cars derailed, including 9 hazardous material cars. Two of the hazardous material cars were damaged. A smoky fire started and approximately 22,000 people were evacuated for 3 hours (Conrail reported 8,000 to FRA). A limited quantity of phosphorous oxychloride spilled. No fatalities occurred, but 25 people were treated for eye or throat irritation. A second evacuation of 14,000 to 16,000 people occurred the following day and lasted 4 hours while the contents of the damaged hazardous material car were removed. Damage to equipment and track was estimated at $653,328.

The cause of the accident was improper train handling by the engineer of the westbound train. The engineer's operational errors were (1) speeding at 60 mph in a 30 mph zone on a curved descending track and (2) improperly manipulating throttle and brake control that resulted in overturning a car. FRA does not enforce speed; therefore, the carrier was not cited for a violation.

The investigation revealed that two event recorder tapes from the westbound train were missing after the accident; however, the event

recorder on the third locomotive was found intact in an unusual location. Because of this incident, FRA suggested more tamperproof housings for the event recorders.

Post-accident toxicology testing revealed that the engineer of the westbound train had ingested controlled substances that can cause drowsiness. This employee had taken the medication, prescribed to someone else, 2 days prior to the accident but none on the day of the accident. However, the long-acting nature of the drug may have adversely affected the engineer's alertness. Under FRA regulations, use of controlled substances by an on-duty employee assigned to perform duties subject to the Hours of Service Act is permissible only if a medical practitioner has determined, based on knowledge of the employee's responsibilities and medical history, that the use of the drug at the prescribed dosage would be consistent with the safe performance of the employee's duties. NTSB cited drugs as a related cause of the accident. Also, as a result of the accident, Conrail changed the signal to slow trains before descending in this area.

Summary of Philadelphia Derailment on January 14, 1987

On January 14, 1987, at 4:37 p.m., three of four cars of an Amtrak passenger train derailed on SEPTA track near the 30th St. Station in Philadelphia. The train derailed while crossing over from one track to another. The train was carrying 50 passengers, but no casualties occurred. Damages to railroad property were estimated at $58,700.

FRA found the probable cause to be a chipped and worn or broken switchpoint that did not properly fit the curve-worn stockrail and that broke further under the movement of the train. On January 12, 1987, a track inspector for SEPTA had noted that the switchpoint needed some work. However, SEPTA did not take immediate corrective action. No violation resulted because FRA normally allows the carrier 30 days to repair a track problem.

Summary of Rasselas Derailment on September 29, 1987

On September 29, 1987, at 5:00 a.m., 20 cars of a 97-car CSX freight train derailed in Rasselas, Pennsylvania. Although 19 hazardous material cars were derailed and 16 damaged, no release of lading (combustible fuel oil and residue crude oil) occurred. There were no casualties. CSX estimated the damage to equipment and track at $281,200.

A 73-inch vertical split in the rail caused the accident. CSX had conducted a rail flaw inspection in March and a routine visual inspection 4

days before the accident, but a split was not detected. No violations resulted from the accident investigation because CSX did not have knowledge of the rail flaw. According to FRA, a fissure within a rail can be difficult to detect even with a rail flaw inspection car. CSX conducts rail flaw inspections semiannually.

Carrier Safety Profile

The tables below provide information on carriers and specifically address the Consolidated Rail Corporation (Conrail) and the former Chessie portion of CSX Transportation, two major freight carriers operating in Pennsylvania. Table II.1 places the carriers into perspective by showing total system operating miles. Table II.2 gives accident statistics, and table II.3 shows dollar damages. Tables II.4 through II.6 show casualty data. Hazardous material involvement appears in table II.7. Table II.8 gives information on rail/highway crossing accidents.

Table II.1: Train Operating Miles (In Thousands) **for Conrail and Chessie**

	1984[a]	1985	1986	1987
All carriers	592,600	570,911	567,099	580,430
Conrail	47,073	44,225	43,873	45,769
Percent of all carriers	7.9	7.7	7.7	7.9
Chessie	30,014	30,404	27,986	[b]
Percent of all carriers	5.1	5.3	4.9	•

[a]For 1984 only, we combined the Baltimore and Ohio Railroad with the Chesapeake and Ohio Railroad. In subsequent years FRA reported the two lines on a combined basis as the Chessie System, although Chessie is now a part of CSX Transportation.

[b]At the time of our review, the FRA data base did not include some data for the Chessie System.

Table II.2: Carrier Accident Profile, by Carrier

	1984	1985	1986	1987
No. of accidents				
All carriers	3,900	3,430	2,761	2,661
Conrail	309	201	141	118
Percent of all carriers	7.9	5.9	5.1	4.4
Chessie	211	230	212	148
Percent of all carriers	5.4	6.7	7.7	5.6
Accident rate[a]				
All carriers	6.58	6.00	4.87	4.58
Conrail	6.56	4.54	3.21	2.58
Chessie	7.03	7.56	7.57	8[b]

[a]Accident rate is per million train miles.

[b]At the time of our review, the FRA data base did not include some data for the Chessie System.

Note: Due to FRA reporting requirements, table II.2 contains duplicate counts of accidents involving more than one carrier. This duplication does not appear in the total for all carriers.

Table II.3: Total Dollar Damage, by Carrier

Dollars in thousands

	1984	1985	1986	1987
All carriers	$240,463	$188,018	$167,549	$180,003
Conrail	10,311	5,438	6,335	5,809
Percent of all carriers	4.3	2.9	3.8	3.2
Chessie	8,793	10,813	8,168	11,115
Percent of all carriers	3.7	5.8	4.9	6.2

Table II.4: Casualties From Accidents and Incidents Combined, by Carrier

	1984	1985	1986	1987
Fatalities				
All carriers	1,181	982	1,031	1,107
Conrail	95	114	84	111
Percent of all carriers	8.0	11.6	8.1	10.0
Chessie	52	52	53	[a]
Percent of all carriers	4.4	5.3	5.1	
Injuries				
All carriers	9,138	8,031	7,373	6,585
Conrail	632	530	388	425
Percent of all carriers	6.9	6.6	5.3	6.5
Chessie	752	696	885	[a]
Percent of all carriers	8.2	8.7	12.0	

[a]At the time of our review, the FRA data base did not include some data for the Chessie System.

Table II.5: Casualties From Accidents, by Carrier

	1984	1985	1986	1987
Fatalities				
All carriers	63	52	51	62
Conrail	2	2	4	0
B&O/C&O/Chessie	2	2	1	[a]
Injuries				
All carriers	893	647	1,117	605
Conrail	31	14	28	21
Chessie	21	25	397	[a]

[a]At the time of our review, the FRA data base did not include some data for the Chessie System.

Table II.6: Casualties From Incidents, by Carrier

	1984	1985	1986	1987
Fatalities				
All carriers	1,118	930	980	1,045
Conrail	93	112	80	111
Chessie	50	50	52	[a]
Injuries				
All carriers	8,245	7,384	6,256	5,980
Conrail	601	516	360	404
Chessie	731	671	488	[a]

[a]At the time of our review, the FRA data base did not include some data for the Chessie System.

Table II.7: Accidents Involving Hazardous Material, by Carrier

	1984	1985	1986	1987
No. of accidents				
All carriers	443	431	370	360
Conrail	34	19	12	16
Percent of all carriers	7.7	4.4	3.2	4.4
Chessie	18	22	18	18
Percent of all carriers	4.1	5.1	4.9	5.0
HM cars involved in accidents				
All carriers	2,826	2,310	1,803	2,180
Conrail	166	70	84	44
Percent of all carriers	5.9	3.0	4.7	2.0
Chessie	170	112	119	106
Percent of all carriers	6.0	4.8	6.6	4.9
HM cars damaged				
All carriers	581	647	453	488
Conrail	81	23	34	35
Percent of all carriers	13.9	3.6	7.5	7.2
Chessie	31	56	40	32
Percent of all carriers	5.3	8.7	8.8	6.6
Cars releasing HM				
All carriers	100	109	79	87
Conrail	7	4	5	10
Percent of all carriers	7.0	3.7	6.3	11.5
Chessie	3	6	5	3
Percent of all carriers	3.0	5.5	6.3	3.4
People evacuated				
All carriers	4,446	11,879	39,701	23,495
Conrail	180	300	210	12,517
Percent of all carriers	4.0	2.5	0.5	53.3
Chessie	0	0	30,406	861
Percent of all carriers	0	0	76.6	3.7

Major Contributors to This Report

Resources, Community, and Economic Development Division, Washington, D.C.

Kenneth M. Mead, Associate Director, (202) 275-1000
Victor S. Rezendes, Associate Director
B. Ann Kleindienst, Group Director
John S. Kalmar, Assignment Manager
Alice G. Feldesman, Social Science Analyst

Philadelphia Regional Office

Richard A. McGeary, Evaluator-in-Charge
Dorothy M. Barrett, Evaluator
Lorna J. Morley, Evaluator
Naveena Daniels Bembry, Evaluator

☆U.S. G.P.O. 1988- 241-164:80323