

Testimony

Before the Subcommittee on Oversight of Government Management, Restructuring and the District of Columbia, Committee on Governmental Affairs, U.S. Senate, and the Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations, Committee on Government Reform, U.S. House of Representatives

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FOOD SAFETY

Continued Vigilance Needed to Ensure Safety of School Meals

Statement of Lawrence J. Dyckman, Director, Natural Resources and Environment



Mr. Chairmen and Members of the Subcommittees:

I appreciate this opportunity to come before you today to discuss the safety of the foods served in our schools. As you know, more than 27 million children are provided low-cost or free meals daily through two federally assisted programs administered by the U.S. Department of Agriculture's (USDA) Food and Nutrition Service (FNS)—the National School Lunch and School Breakfast programs. In fiscal year 2001, these programs were funded at about \$8 billion dollars. According to the Centers for Disease Control and Prevention (CDC), between 1990 and 1999, nearly 300 outbreaks of foodborne illness occurred in schools affecting approximately 16,000 children. Outbreaks of foodborne illness in our schools are of particular concern because of children's vulnerability to harmful pathogens. According to CDC, only a fraction of foodborne illnesses are sporadic, only a small number are identified as being part of an outbreak.¹

In February 2000, we reported that USDA should take actions to better ensure the safety of foods served in federal school meal programs.² In response to your request, Mr. Chairmen, our testimony today (1) provides information on the frequency of outbreaks of foodborne illness in schools between 1990 and 1999, (2) discusses the status of our February 2000 recommendations to better safeguard the food served in our schools, (3) offers additional observations on how the safety of the school meal programs could be further enhanced, (4) discusses the status of efforts to minimize the risk of deliberate contamination of school meals, an issue of heightened importance in the wake of recent events, and (5) because the safety of the school meals hinges on the effectiveness of the nation's overall food safety system, our testimony summarizes several endemic problems that we have found in the federal food safety system as a whole.

Results in Brief

Our current analysis of CDC's outbreak data shows an increase in the number of school-related outbreaks reported to CDC between 1990 and 1999 (the last year for which complete outbreak data is available). Overall, our analysis of these data indicates that the rise in the number of

¹ CDC defines an outbreak as an incident in which two or more persons experience a similar illness after ingestion of a common food.

² U.S. General Accounting Office, *School Meal Programs: Few Outbreaks of Foodborne Illness Reported*, GAO/RCED-00-53 (Washington, D.C.: Feb. 22, 2000).

outbreaks reported in schools since 1990 mirrors the rise in the number of outbreaks reported in the general population. We cannot determine the extent to which foods served in the school meal programs are the cause of reported outbreaks because CDC's data also includes outbreaks that are attributable to foods brought from home or other sources. Our examination of 20 large school outbreaks in 1998 and 1999 does show, however, that the majority of the outbreaks in those years were caused by foods served through the school meal programs. CDC attributes much of the increases in reported outbreaks to the improved data collection procedures initiated in 1998, when it began encouraging states to report foodborne outbreaks and to verify the data they submitted. CDC also suggests that increased resources for outbreak investigations and greater pubic awareness regarding foodborne disease might also account for the increased number of reported outbreaks. However, after accounting for CDC's more active surveillance approach, our analysis revealed an increase in reported outbreaks in schools, generally averaging 10 percent per year. Our analysis also shows that, of those outbreaks with a known cause, the most commonly identified cause of the illnesses were foods contaminated with salmonella and Norwalk-like viruses.³

USDA has been, for the most part, responsive to the two recommendations we made in our February 2000 report. Our first recommendation entailed USDA establishing a database to track all of the actions it takes to hold or recall USDA-donated foods that could potentially cause foodborne illness in schools. We made this recommendation so that USDA could document its responsiveness to food safety concerns and potentially identify problematic vendors or foods. USDA agreed with our recommendation and established a database that currently contains records of 11 food safety actions. We also recommended that USDA revise its school food service manual to include guidance for state and local school authorities on enhanced safety provisions that are normally included in USDA's procurement contracts for donated foods. USDA plans to address our recommendation by revising its school procurement guidance to include an example that addresses safety concerns. However, we believe USDA should include more information that would be useful to schools. We made this recommendation because state and local school food authorities

³ Food contaminated with salmonella may cause nausea, vomiting, diarrhea, and headaches. Nausea, vomiting, diarrhea, and abdominal pain also characterize Norwalk-like viral infections. Headache and low-grade fever may also occur.

purchase 83 percent of the dollar value of foods for the school lunch program.

Based on the limited work we conducted in preparing for this testimony, we have identified two other issues that may warrant additional study and could contribute to improving the safety of school meals. First, as we reported in February 2000, USDA's procurement officials have routine access to the federal inspection and compliance records of potential suppliers, and they take these records into account when considering bids before contracting for donated foods. However, our recent interviews with USDA officials suggest that there is currently no mechanism for state and local authorities to easily and routinely access such information. Because state and local school authorities purchase the majority of foods for school meals, they may benefit from having ready access to the inspection and compliance information that the U.S. Department of Health and Human Services' Food and Drug Administration (FDA) and USDA collect. Such data sharing could enable them to make more informed purchasing decisions. USDA officials stated that this idea would have to be explored further to address potential legal impediments to such information sharing. FDA officials said that the idea might have merit. Second, in the course of preparing for this testimony, we observed that FNS has an established process for holding and recalling USDA-donated foods when safety concerns arise. As the single common point of contact for all schools participating in the school meal programs, FNS may want to study the possibility of extending its hold and recall procedures to include school-purchased foods. In this manner, FNS would coordinate and track safety actions pertaining to all foods served in the school meal programs rather than just those pertaining to USDA-donated foods. USDA officials agreed with this concept and indicated that they intend to share the hold and recall procedures with schools in fiscal year 2003.

USDA and FDA have not developed specific security provisions to protect food served in the school meal programs from potential deliberate contamination. But, according to USDA and FDA officials, actions designed to enhance the security of the federal food safety system as a whole would also enhance the security of school meals. As we testified in October 2001, recent events have raised the specter of bioterrorism as an emerging risk factor for our food supply. Moreover, under the current structure, there are questions about the food safety system's ability to detect and quickly respond to any such event. Since our October 2001 testimony, FDA and USDA officials stated that they are better prepared to detect and respond to such an event. The agencies are in the process of conducting risk assessments to determine where in the farm-to-table food continuum the food supply may be most vulnerable. In addition, FDA has issued voluntary guidelines to the sectors of the food industry that it regulates to enhance, among other things, the physical security of processing and storage facilities. USDA is also working on a similar set of guidelines. Finally, agency officials told us that they have asked their field personnel to be on heightened alert for potential security concerns.

Finally, Mr. Chairmen, as we have frequently reported in the past, a series of structural weaknesses in our federal food safety system can affect all consumers, including children who eat school meals. As we reported in February 2000, while no federal agency specifically monitors the safety of school meals, USDA and FDA are responsible for enforcing regulations that ensure the safety of the nation's food supply. As we testified in October 2001 the existing food safety system is a patchwork structure that hampers efforts to adequately address existing and emerging food safety risks whether those risks involve inadvertent or deliberate contamination.⁴ The food safety system is affected by a series of overarching problems that impede efforts to address public health concerns associated with existing and emerging safety risks. For example, when unsafe foods are detected, neither USDA nor FDA has the authority to recall them from distributors, although the appropriate agency can request manufacturers to do so voluntarily. Therefore, today we re-emphasize the need for the creation of a single food safety agency with new legislative authority. Such an action would go a long way toward improving overall food safety.

Background

The extent of foodborne illness in the United States and its associated costs are significant. CDC estimates that unsafe foods cause as many as 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths annually.⁵ In terms of medical costs and productivity losses, foodborne illnesses associated with seven major pathogens cost the nation between \$7 billion and \$37 billion annually, according to USDA's estimates.

⁴ U.S. General Accounting Office, *Food Safety and Security: Fundamental Changes Needed to Ensure Safe Food*, GAO-02-47T (Washington, D.C.: Oct. 10, 2001).

⁵ On Apr. 19, 2002, CDC reported that there has been a decrease in several major bacterial foodborne illnesses, including infections due to salmonella, campylobacter, and listeria. However, CDC has not revised its estimates of the overall incidence of foodborne illness in the United States.

The National School Lunch Program and the School Breakfast Program share the goals of improving children's nutrition, increasing lower-income children's access to nutritious meals, and supporting the agricultural economy. The school lunch program is available in almost all public schools and in many private schools. About 70 percent of those schools also participate in the breakfast program. Schools participating in the school lunch or breakfast programs receive a per-meal federal cash reimbursement for all meals they serve to children, as long as the meals meet federal nutrition standards. In fiscal year 2001, school meal programs provided lunch, breakfast, and snacks to over 27 million school children daily.

At the federal level, FNS administers the school meal programs. At the state level, the program is usually administered by state education agencies, which operate them through agreements with local school food authorities. Overall, USDA donates about 17 percent of the dollar value of food that goes on the table in school lunch programs through its Food Distribution Program. USDA purchases and distributes commodities to remove surpluses from the marketplace and to provide nutritious foods to the nation's children. Schools purchase the remaining 83 percent of the dollar value of food served using USDA's cash reimbursement and their own funds. In fiscal year 2001, the total cost of the school meal programs—including cash reimbursements to schools, USDA purchases of donated foods, and program administration—was nearly \$8 billion. By far the largest component of the school meal programs is the school lunch program. In fiscal year 2001, the school lunch program cost about \$5.7 billion.

The procurement process for foods served in school lunch program differs depending on whether federal or state/local food authorities procure the foods (see figure 1).

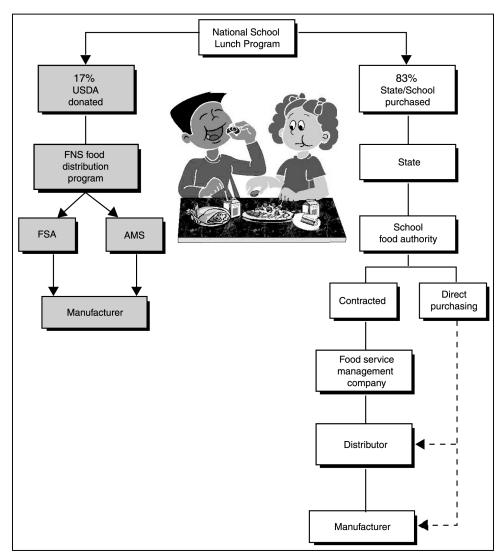


Figure 1: School Lunch Program Procurement Process

USDA's Agricultural Marketing Service (AMS) and Farm Service Agency (FSA) are responsible for procuring USDA-donated foods. The Agricultural Marketing Service purchases meat, poultry, fish, and fruits and vegetables for donation; the Farm Service Agency purchases grains, oils, peanut products, dairy products, and other foods. USDA contracts for the purchase of these products with manufacturers that are selected through a formally advertised competitive bidding process. FNS, through its Food Distribution Division, provides the donated foods to state agencies for

	distribution to schools. Schools then purchase the remainder of food for school meals independently using their own procurement practices, either purchasing foods directly from manufacturers or distributors, or contracting with food service management companies that procure the foods for them.
	USDA provides little guidance to promote safety in school food procurements. FNS' guidance to schools emphasizes safe food handling because, according to USDA officials, most cases of foodborne illness at schools are due to poor food storage, handling, and serving practices. Therefore, the priority is on guidance to ensure food safety through proper handling and preparation of foods at schools. For example, manuals are provided that address appropriate temperatures for reheating ready-to-eat foods and for hot-holding potentially hazardous foods. Similarly, FNS provides information on employee personal hygiene and how it relates to cross-contamination of foods.
Data Show an Increase in School Outbreaks	CDC's outbreak data shows an increase in the number of school-related outbreaks since 1990. Between 1990 and 1999 (the most recent year for which complete outbreak data is available from CDC), 292 school-related outbreaks were reported to CDC, averaging 17 outbreaks in the first 4 years of the decade, 28 in the next 4 years, and 57 in the final 2 years (see table 1). In total, approximately 16,000 individuals, mostly children, were affected. ⁶ For those outbreaks with a known cause, the most commonly identified cause of the illnesses were foods contaminated with salmonella or Norwalk-like viruses.

⁶ According to CDC, foodborne illnesses are underreported because (1) milder cases are often undetected; (2) pathogens that are transmitted through food may also be spread through water or from person to person, obscuring the role of foodborne transmission; and (3) some proportion of foodborne illness is caused by pathogens or agents that have not yet been identified and thus cannot be diagnosed. Furthermore, CDC relies on states to voluntarily report outbreak information.

Year	School Outbreaks	Other Outbreaks	School Illnesses	Other Illnesses
1990	25	508	1212	18,019
1991	14	517	486	14,566
1992	14	397	991	10,092
1993	15	499	676	13,404
1994	31	659	1,807	15,188
1995	9	636	436	13,061
1996	32	570	1,772	13,649
1997	39	767	2,026	16,776
1998	63	1,251	3,944	22,775
1999	50	1,294	2,882	22,404
Total	292	7,098	16,232	159,934

Table 1: Outbreaks and Illnesses in Schools and Non-School Settings, 1990-1999

Note: As explained later, this outbreak data includes outbreaks caused by foods in the school meal programs as well as foods brought from home.

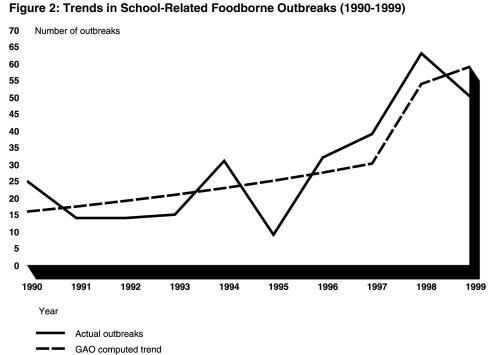
Source: Centers for Disease Control and Prevention data.

According to CDC officials, some unknown portion of the increase in reported outbreaks extends from CDC's transition from a completely passive surveillance data collection method to a more active surveillance methodology in early 1998. In effect, CDC went from accepting data from the states to actively soliciting states for more comprehensive information and having the states verify the information that they submit. As a result, states began to report more of all types of foodborne outbreaks, including school outbreaks, to CDC beginning in 1998. Moreover, CDC suggests that increased resources for outbreak investigations and greater awareness among the general public about foodborne disease might also account for the increased number of reported outbreaks.

To evaluate the trend in the number of school outbreaks, and in their number relative to non-school outbreaks, we compared the observed numbers to the estimated numbers of school and non-school outbreaks.⁷ This analysis shows that there is an upward trend in foodborne illness outbreaks reported in schools between 1990 and 1999 and that not all of this increasing trend is attributable to changes that took place when CDC began a more active data collection effort. Outbreaks in the general

⁷ We used traditional statistical tests to determine how well the different models fit the observed data and which models were preferable to distinguish the pattern in the observed data from random fluctuations.

population have increased by a comparable amount over the same period; therefore, there is no statistically significant difference between increased outbreaks in schools and increased outbreaks in general. As figure 2 shows, our analysis of CDC's data indicates that, even after adjusting for CDC's improved data collection, the number of school-related foodborne outbreaks increased, on average, about 10 percent per year between 1990 and 1999.



We also analyzed trends in participation in the school meal programs over this same time period and found that the changes in school outbreaks reported did not simply mirror changes in the number of students participating in the school meal programs. While the number of reported school outbreaks doubled over the decade, and generally increased by an average of about 10 percent from one year to the next, the number of school lunch participants increased by only 12 percent over the entire decade, or by just over 1 percent per year. Thus, the increase in school outbreaks reported is not explained by the increase in children's participation in the school meal programs.

Source: GAO's analysis of CDC data.

	One should exercise caution, however, when analyzing school outbreak data. CDC's data must be supplemented with more detailed state or local information to determine the extent of foodborne illness outbreaks actually associated with the school meal programs in any given year. We gathered additional state and local health department information for the 20 largest school outbreaks in CDC's database for 1998 and 1999, each of which resulted in 100 or more illnesses. We determined that 13 of the 20 outbreaks (65 percent) were associated with foods served in the school meal programs. Three of the 13 outbreaks were linked to tainted burritos that were distributed to schools nationwide and are thought to have caused approximately 1,700 illnesses. The other 7 outbreaks were not linked to foods served in the school meal programs, but with foods brought to schools from home or other sources. Therefore, data limitations make it difficult to assert with complete certainty to what extent the foods served in the school meal programs are the cause of the reported outbreaks from 1990 to 1999.
USDA Has Been Largely Responsive to Our February 2000 Recommendations	USDA has, for the most part, been responsive to the two recommendations we made in our February 2000 report. First, we recommended that USDA develop a database to track the actions it takes to hold or recall donated foods when safety concerns arise regarding foods donated to the school meal programs. Second, we recommended that the agency revise its school food service manual to include guidance regarding food safety procurement contract provisions, which could be used by state and local school authorities.
	We made our first recommendation because, without comprehensive records of such safety actions, USDA had no reliable basis for identifying problematic foods or suppliers, or for documenting the agency's responsiveness to concerns over the safety of USDA-donated foods. In response to our February 2000 recommendation, USDA implemented its food safety action database in April 2000. The database identifies and tracks key hold and recall information starting in October 1998. As of April 2002, the database lists 11 food safety actions, including, for example, the recall of 114,000 pounds of chicken that was contaminated with listeria in February 2000. ⁸ Because of the limited number of actions recorded thus

 $^{^{\}rm 8}$ Listeria is a foodborne contaminant that can cause meningitis, septicemia, and perinatal disease.

far, USDA has not conducted any analysis of the information contained in the database, but plans to continue maintaining it for future use.

We made our second recommendation because, although USDA has established procurement policies and procedures to ensure the safety of foods donated to schools, these policies and procedures do not apply to foods purchased independently by schools. For example, contracts for donated foods may specify pathogen testing for every lot of certain products that are highly susceptible to contamination, or may contain contract provisions that establish specific temperature requirements for chilled and frozen products during processing and storage at the plant, transportation between processing plants, upon shipment from the plant, and upon arrival at final destination. However, there is no requirement that state and local authorities include similar food safety provisions in their procurement contracts. According to USDA's regulations for schools participating in the school meal programs, the responsible school food authority may use its own procurement procedures, which reflect applicable state and local laws and regulations. Therefore, the extent to which schools address safety in their food procurement contracts may vary depending on state and local laws and procurement guidance that is available to them. To assist state and local authorities, we recommended that USDA provide them guidance on food safety provisions that could be included in their procurement contracts.

USDA officials told us that they plan to address our recommendation by revising the school procurement guidance to include an example that addresses safety concerns. We believe, however, that USDA should include more information that would be useful to schools. Specifically, providing a list of the specific food safety provisions found in USDAdonated food contracts would help schools in preparing their own food procurement contracts. While USDA officials contend that local school districts have little negotiating power to require safety provisions because their purchases are mainly low-volume from commercial sources, USDA's own data indicates that in the 1996-1997 school year, the latest year for which this data was available, 37 percent of school food authorities participated in cooperative arrangements that purchase in larger volume. Therefore, we believe that more detailed information on contract safety provisions could enhance the safety of foods purchased directly by schools. In particular, since local school authorities purchase 83 percent of the dollar value of school meals, it is important that they receive guidance from FNS on how best to achieve a comparable level of safety precautions through their procurement process.

Potential Opportunity to Further Enhance the Safety of School Meals	Based on limited work conducted in preparation for this testimony, we offer two additional observations that, if validated by further study, may contribute to greater safety for school children at minimal cost. First, USDA's procurement officials told us that they have routine access to federal inspection and compliance records of potential suppliers and that they consider this information when they review bids before contracting. However, there is currently no established mechanism for state and local authorities in charge of purchasing food for schools to easily and routinely access such information. It may be desirable for USDA to consider whether it should provide state and local school officials with access to information collected through FDA's and USDA's inspections of school lunch food suppliers, potentially enabling them to make more informed purchasing decisions. USDA officials stated that this idea is worth considering.		
	Second, FNS has developed a process for holding foods suspected of contamination that applies exclusively to food commodities that USDA purchases for donation to schools. The hold allows time for additional testing and inspection prior to asking for a recall of donated foods when safety concerns arise. Because FNS is the single common point of contact for all schools participating in the school meal programs, and because it does provide guidance to the schools on food nutrition and quality, an extension of FNS' hold and recall procedures to include non-donated (school-purchased) foods would seem logical. USDA officials agreed with this concept and indicated that they intend to share the hold and recall procedures with schools in fiscal year 2003.		
There Are No Special Security Provisions for the School Meal Programs	USDA and FDA have not developed any specific security provisions to help protect food served through the school meal programs from potential deliberate contamination. But, according to USDA and FDA officials, actions designed to enhance the security of the federal food safety system as a whole would also enhance the security of meals served at schools. As we testified in October 2001, however, recent events have raised the specter of bioterrorism as an emerging risk factor for our food safety system We further stated that under the current structure, there are questions about the system's ability to detect and quickly respond to any such event. Since our October 2001 testimony, both FDA and USDA have stated that they are better prepared to detect and respond to such an event. Both agencies are in the process of conducting risk assessments to determine where in the farm-to-table food continuum there is a critical		

	need to provide additional resources. In addition, FDA staffing has already
	increased inspections of imported foods, added more inspections of domestic producers, and more laboratory testing of food products. Further, FDA has issued voluntary security guidelines to the sector of the food industry that it regulates on the need to (1) ensure physical security of processing and storage facilities, (2) ensure that chemical and biological agents that may be kept in their facilities or at in-house laboratories are under appropriate controls, and (3) verify the background of plant employees. Currently, the agency is receiving public comments and expects to revise the guidelines. USDA is also working on a similar set of guidelines that meat, poultry, and egg products processors could voluntarily adopt. Finally, agency officials told us that they have generally asked their field personnel to be on heightened alert for potential security concerns. We are initiating a review to determine how these guidelines are being implemented and how federal agencies plan to monitor their implementation.
Overarching Problems in the National Food Safety System Also Affect the Safety of School Meals	As we reported in February 2000, while no federal agency monitors the safety of school meals, USDA's Food Safety and Inspection Service (FSIS) and FDA are responsible for enforcing regulations that ensure the safety of the nation's food supply. FSIS is responsible for the safety of meat, poultry, and some eggs and egg products, while the FDA is responsible for all other foods, including fish, fruit, vegetables, milk, and grain products. However, as we stated most recently in our October 2001 testimony, the existing food safety system is a patchwork structure that hampers efforts to adequately address existing and emerging food safety risks whether those risks involve inadvertent or deliberate contamination. The food safety system is also affected by other overarching problems, such as the challenge of effectively coordinating the food safety activities of multiple agencies including coordinating multi-state outbreaks. For example, the current organizational and legal structure of our federal food safety system has given responsibility for specific food commodities to different agencies and provided them with significantly different regulatory authorities and responsibilities. As a result, we have inefficient use of resources and inconsistencies in oversight and enforcement.

we reported in August 2000,⁹ neither USDA nor FDA had provided guidance to industry on how to quickly initiate and carry out food recalls that involve potentially serious adverse health risk. We recommended that such guidelines instruct companies on time frames for quickly initiating and carrying out recalls, including procedures that expeditiously notify distribution chains and alert the public. USDA has revised its guidelines, and FDA is in the process of revising its guidance and expects to reissue the guidance in September 2002.

Finally, Mr. Chairmen, in working on food safety issues over the past decade, we have reviewed USDA's and FDA's inspection systems and identified weaknesses in both. The agencies agreed with most of our recommendations and have either taken steps or are taking steps to improve inspections. We have also focused on specific products, many of which are included in school meals. For example, because of concerns about the risk of salmonella in eggs, we reviewed the adequacy of the federal system for ensuring egg safety. Our work shows that the current regulatory and organizational framework for egg safety makes it difficult to ensure that resources are directed to areas of highest risk. Similarly, we evaluated the seafood and shellfish safety program and determined that theses programs do not sufficiently protect consumers because of weaknesses in FDA's implementation of the new science-based inspection system. FDA agreed with most of our recommendations. We also reviewed USDA's oversight of meat and poultry products and concluded that, in order to better ensure safety, USDA needed to ensure that inspectors are properly trained on the new science-based system. USDA agreed with our recommendation and is providing enhanced training. In January 2002,¹⁰ our report on mad cow disease concluded that, although bovine spongiform encephalopathy (BSE) has not been found in the United States, federal actions do not sufficiently ensure that all BSE-infected animals or products are kept out of the country or that if BSE were found, it would be detected promptly and not spread. FDA, USDA, and Customs generally agreed with the report's recommendations.

⁹ U.S. General Accounting Office, *Food Safety: Actions Needed by USDA and FDA to Ensure that Companies Promptly Carry Out Recalls*, GAO/RCED-00-195 (Washington, D.C.: Aug. 17, 2000).

¹⁰ U.S. General Accounting Office, *Mad Cow Disease: Improvements in the Animal Feed Ban and Other Regulatory Areas Would Strengthen U.S. Prevention Efforts*, GAO-02-183 (Washington, D.C.: Jan. 25, 2002).

Conclusions

Mr. Chairmen, in conclusion, schools face the difficult task of providing healthy, nutritious meals to millions of children daily. As the data indicate, the number of school-related foodborne illness outbreaks reported between 1990 and 1999 has generally increased despite the efforts of these schools, as well as the federal regulatory agencies, to prevent tainted food from reaching cafeteria plates. We believe that to make substantial improvements in the safety of school meals will require, in part, addressing the overarching problems that affect the nation's federal food safety system as a whole. Nevertheless, as we have discussed today, there are steps that USDA could take within the existing safety system to better ensure the safety of school meals, such as providing state and local school authorities with specific food safety provisions that could be included in their procurement contracts. Additionally, continued vigilance is necessary to determine the true extent and cause of the problems, to ensure that schools obtain the safest food possible for our children, and also to ensure that unsafe foods are promptly and effectively withdrawn from schools when illnesses occur.

Mr. Chairmen, this completes my prepared statement. I would be happy to respond to any questions you or other members of the Subcommittees may have.

Contacts and Acknowledgments

For future contacts regarding this testimony, please contact Lawrence J. Dyckman at 202-512-3841. Individuals making key contributions to this testimony included Maria Cristina Gobin, Brad Dobbins, John M. Nicholson, Jr., John C. Johnson, Doug Sloane, Stuart Ryba, and Maria-Alaina I. Rambus.