

## Chicago Area Methyl Parathion Response

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The Illinois Department of Public Health participated in the Chicago, Illinois, area methyl parathion (MP) response with several other federal, state, and local government agencies beginning in April 1997. This response was initiated on evidence that hundreds of homes in the Chicago area were illegally treated for cockroaches with MP over a period of several years. Through applicator receipt books and information reported by property owners and tenants, 968 homes were identified as having been treated with MP. Upon implementation of a response plan developed by the Methyl Parathion Health Sciences Steering Committee, environmental sampling and urine monitoring were provided for eligible households. Environmental sampling was conducted in 903 homes, with MP detected above levels of concern in 596 residences. Residents of these homes were offered urine sampling to determine the extent of exposure to MP. Urine samples were collected and analyzed for *p*-nitrophenol in 1,913 individuals. Implementation of the protocol resulted in 550 residents being relocated during the remediation of 100 households. *Key words:* creatinine, methyl parathion, *p*-nitrophenol, urine sampling, wipe samples. *Environ Health Perspect* 110(suppl 6):1075–1078 (2002).

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### Overview

**Illegal pesticide application.** In early April 1997, information provided by authorities in Mississippi to the U.S. Environmental Protection Agency (U.S. EPA) Region 5 led to the discovery of an illegal methyl parathion (MP) spraying operation in the Chicago, Illinois, area. MP was used illegally to treat for cockroaches in residences. Under federal warrant, the U.S. EPA seized more than 200 gallons of MP concentrate, spraying equipment, empty containers of MP, and business records from the home of the illegal operator on 9 April 1997. The records and receipts of the illegal pest control operator (PCO) identified hundreds of names, addresses, and phone numbers of customers dating to the early 1990s. The addresses from the log books were entered into a database and potentially contaminated homes were identified throughout the west and south sides of Chicago and in neighboring western suburbs. Many of these addresses consisted of multiple households. The PCO was arrested in April 1997 and pleaded guilty to the charges of illegal pesticide application in July 1997. He was subsequently sentenced in December 1997 to serve 2 years in prison.

**Multiagency task force.** In mid-April 1997 the federal Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. EPA organized an MP multiagency task force in Chicago to develop and coordinate federal, state and local response efforts. The task force included representatives from the ATSDR, U.S. EPA, Illinois Department of Public Health (IDPH),

Chicago Department of the Environment (CDOE), Illinois Environmental Protection Agency (IEPA), Illinois Department of Agriculture, Cook County Department of Public Health (CCDPH), Chicago Department of Public Health (CDPH), Illinois Cooperative Extension Service, Illinois Poison Control Center, and Great Lakes Center for Environmental and Occupational Health. These agencies and groups provided the staff and resources for the Chicago area MP response.

The task force identified several primary goals of the MP response: to characterize the extent of MP contamination in homes, to minimize or eliminate exposure to MP, to identify affected individuals and provide medical treatment if necessary, to educate area residents and health care providers about the health effects of exposure to MP, and to provide residents and property owners with alternative pest-management strategies. The Chicago area MP response plan was based primarily on the "Proposal for para-Nitrophenol Monitoring in Urine to Track Exposure to Methyl Parathion" developed by the Methyl Parathion Health Sciences Steering Committee led by ATSDR and U.S. EPA in April 1997 (1). This document outlined environmental and biologic levels of concern and sample criteria implemented by the task force. An MP expert panel also was convened by ATSDR to review and comment on the steering committee report. The expert panel identified data gaps that could affect the efficacy of the response, but the panel concurred with the

overall recommendations of the steering committee (2).

**Environmental sampling.** Potentially affected households were identified from more than 40 receipt books confiscated from the home of the applicator. Additional households were identified from an MP hotline that was established at the beginning of the response by the task force. The hotline number was printed and distributed in all fact sheets developed for the response and it was included in all communications with residents of potentially affected homes. Local news media also printed and displayed the hotline number over a period of several days as the extent of contamination was being investigated. All potentially treated homes were eligible for environmental sampling to characterize the extent of MP contamination.

Environmental sampling protocols were developed by the U.S. EPA to provide uniform sample information for affected homes (3). A maximum of nine wipe samples were collected from each residence on swabs charged with isopropyl alcohol. Sample locations included kitchen, living room, primary and secondary bedroom baseboards, kitchen counter top splash board, and under the kitchen sink. Composite samples from high contact areas in the living room and primary bedroom were also collected in most homes. The sample collection protocol included personal protection specifications for sample team members.

Environmental sampling was scheduled by CDPH and CCDPH. Environmental sampling teams were led by the U.S. EPA and IDPH, with trained personnel from several participating agencies. These sampling teams were assisted by the U.S. EPA, IEPA, and CDOE community relations staff who distributed fact sheets and answered questions about the process. Community relations staff also administered a household questionnaire to gather demographic and exposure information, as well as health effect information.

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Information about the health of pets also was obtained and was self-reported and unverified. The household questionnaires were sent to IDPH daily for review to prioritize sampling of homes on the basis of any problematic health conditions.

Environmental samples were collected, documented, and sent to U.S. EPA or IDPH laboratories for analysis. IDPH received environmental sampling results and household questionnaires and entered the information into a department database. IDPH contacted persons with health questions and provided information or made referrals for medical follow-up.

If the average level of MP in the household environmental samples was <15 µg/100 cm<sup>2</sup>, the household was cleared for no further action (1). Clearance letters and educational materials with information about proper methods of pest control were sent to these households.

If MP was found at an average concentration of ≥15 µg/100 cm<sup>2</sup> in surface residue samples in a household, urine sampling was recommended for all residents in the home (1).

**Urine sampling.** Residents who were candidates for urine sampling were sent a letter notifying them of their eligibility and providing information about MP and urine sampling procedures. CDPH and CCDPH were then provided a list of households eligible for urine sampling. Protocols for collecting morning (A.M.) and evening (P.M.) urine samples were developed by the Methyl Parathion Health Science Steering Committee (1) and collection forms and questionnaires were developed by the task force. Initially, local health department nurses contacted eligible households to schedule appointments for urine sampling. IDPH and ATSDR trained the nurses to handle samples properly, to administer questionnaires, and to answer questions. Nurses traveled to the homes and met with residents to explain the process and to provide sample cups. The nurses returned to the household the following day and collected the urine sample cups and administered the urine sample questionnaires. The samples were transported to the IDPH laboratory in Chicago for processing, freezing, and shipment. The urine samples were then sent to the Centers for Disease Control and Prevention (CDC) laboratory in Atlanta, Georgia, for analysis. Samples were tested for para-nitrophenol (PNP), a metabolite of MP. All questionnaires and paperwork were sent to IDPH for data entry.

The use of local health nurses in Chicago proved to be problematic. The collection of urine samples for MP was a task added to an already extensive work load. When funding from ATSDR became available in the summer

of 1997, contract nurses were hired by CDPH. These nurses were trained and assigned the exclusive task of collecting urine samples from residents within the Chicago city limits. This revision in the response was extremely effective and improved the urine collection process in Chicago.

The CDC laboratory analyzed the urine samples, adjusted the sample results for creatinine (CR), and reported the results to

IDPH. The urine results and questionnaire information were entered into the IDPH database, and households were categorized based on criteria in the “Proposal for para-Nitrophenol Monitoring in Urine to Track Exposure to Methyl Parathion” (Table 1) (1). Households eligible for relocation were referred to the U.S. EPA. IDPH sent letters and information to households that required quarterly urine sampling or no further action.

**Table 1.** Methyl parathion urine and environmental sampling criteria for household classification and relocation.<sup>a,b</sup>

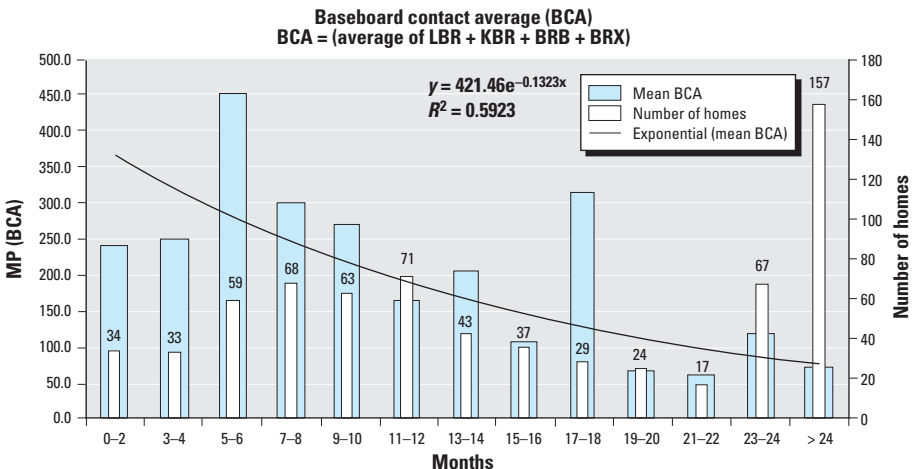
Recommended action	No further action	Urine monitoring <sup>c</sup>	Relocation
Age group			
<1 year and pregnant women	<25 ppb in urine; <50 µg/100 cm <sup>2</sup> exposure-based sampling	25–50 ppb in urine; or <25 ppb in urine and ≥50 µg/100 cm <sup>2</sup> exposure-based sampling	>50 ppb in urine
≥1 – <16 years	<100 ppb in urine; <50 µg/100 cm <sup>2</sup> exposure-based sampling	100–300 ppb in urine; or <100 ppb in urine and ≥50 µg/100 cm <sup>2</sup> exposure-based sampling	>300 ppb in urine
≥16 years	<300 ppb in urine; <50 µg/100 cm <sup>2</sup> exposure-based sampling	300–600 ppb in urine; or <300 ppb in urine and ≥50 µg/100 cm <sup>2</sup> exposure-based sampling	>600 ppb in urine

<sup>a</sup>All exposure-based sampling is averaged. <sup>b</sup>All urine numbers are CR adjusted; if CR numbers are not available, weight basis is used. <sup>c</sup>The initial urine sampling event will be based upon two discrete urine samples; the higher result will be used for decisions. Frequency of urine monitoring will be once a quarter until the infant reaches 12 months of age. For all other groups, monitoring will be conducted on a quarterly basis (regular intervals) for a minimum of 1 year to confirm the exposure scenario. Once the decision is made to collect urine samples in a house, all residents are to be offered monitoring. Any individual from any category who exceeds established relocation benchmarks will trigger relocation. Data from Methyl Parathion Health Sciences Steering Committee (1).

**Table 2.** Environmental sampling summary for methyl parathion in Chicago area homes.

Sample location	Max (µg MP/100 cm <sup>2</sup> )	Mean (µg MP/100 cm <sup>2</sup> )
Kitchen baseboard composite (KBR), n = 895	9,750	242
Living room baseboard composite (LBR), n = 894	13,873	143
Bedroom 1 baseboard composite (BRB), n = 887	5,047	151
Bedroom 2 baseboard composite (BRX), n = 191	2,480	140
Average of KBR + LBR + BRB + BRX (BCA), n = 903	4,884	179
Composite of three high-contact areas (HCA), n = 896	994	10
Under kitchen sink (UKS), n = 886	12,000	217
Kitchen countertop/splash (KCS), n = 849	12,300	153

n, number of households sampled.



**Figure 1.** Methyl parathion environmental degradation in Chicago area homes.

Notification letters also were sent to landlords of rental households. Residents eligible for quarterly urine sampling were contacted about 12 weeks after their previous sampling to schedule an appointment for the next quarter sampling. This was done for 1 year to ensure that MP exposure was not increasing.

**Relocation and remediation.** The U.S. EPA assembled a team to coordinate relocation activities. Team members included representatives from the U.S. EPA, CDPH, CCDPH, and IDPH. All remedial activities were conducted by local hazardous waste contractors with oversight by the U.S. EPA on-scene coordinator.

A U.S. EPA community relations team met with residents before relocation to explain the procedure. Photographs were taken and household items were inventoried to document the status of the home prior to remediation. Residents were moved to nearby temporary housing and transportation was provided for children so they could continue

to attend their neighborhood schools. Contractors removed and replaced contaminated building materials and tested the home to ensure clearance levels of  $<15 \mu\text{g}/100 \text{ cm}^2$  were met before reoccupancy was allowed.

**Health education.** IDPH worked with ATSDR Region 5 and the Great Lakes Center for Environmental and Occupational Health to provide community and health professional education. IDPH also assisted ATSDR and its contractor, Oak Ridge Institute for Science and Education, in developing materials for health professionals. A copy of a health professional fact sheet was sent electronically to emergency department personnel throughout the Chicago area. These education efforts improved participation in the urine sampling.

## Results

**Scope of sampling and response.** Through applicator receipt books and the MP hotline, 968 homes were identified as having been treated with MP. Of those homes, 903 were environmentally sampled. Sampling was not

conducted in 65 homes because property owners refused access or the property was vacant. Of the 903 homes sampled, 307 had MP levels  $<15 \mu\text{g}/100 \text{ cm}^2$  and were cleared from further investigation. MP levels  $\geq 15 \mu\text{g}/100 \text{ cm}^2$  were detected in 596 homes. These homes were eligible to participate in the urine monitoring phase of the response. A summary of environmental sample results is presented in Table 2.

Degradation of MP in the home was evaluated with questionnaire information regarding the last estimated spray date and the baseboard contact average (BCA) that was calculated from all baseboard samples in the home (Figure 1). An estimated half-life of about 300 days was calculated assuming an exponential decay curve.

Initial urine samples were collected from residents of 496 households. Individuals from 100 households refused to participate in the urine monitoring. Urine samples were collected from 1,913 individuals from these 496 households: 1,100 adults ( $\geq 16$  years of age); and 813 children, ( $<16$  years of age). From the initial urine sampling, 93 households were recommended for relocation and remediation, 261 households were recommended to participate in quarterly monitoring, and 311 households were determined to require no further action.

Participation in quarterly urine monitoring gradually decreased. Of the 261 households recommended to participate in the quarterly monitoring, residents from only 175 households submitted second-quarter urine samples (Table 3). Third-quarter samples were collected from only 81 households, and 66 households submitted fourth-quarter samples (Table 3). On the basis of quarterly monitoring, relocation and remediation were recommended for nine households.

By the end of the MP response in December 1998, 102 households were recommended for relocation and remediation. This included 550 residents: 232 adults ( $\geq 16$  years of age) and 318 children ( $<16$  years of age). Residents from two households refused to relocate and allow remediation of their homes.

The majority of relocations were triggered by children  $<6$  years of age (Table 4). This group also demonstrated the highest CR-adjusted PNP (PNP/CR) levels (Table 5).

**Health implications.** Individuals from 225 homes reported illness after MP spraying. Symptoms based on households included headaches (67 households), nausea (41 households), flulike symptoms (27 households), vomiting (23 households), dizziness (21 households), skin rash (9 households), and respiratory effects (9 households). Medical attention for these symptoms was reportedly sought by residents of 96 households. Residents from 128 households were able to

**Table 3.** Quarterly urine monitoring summary for Chicago area homes with methyl parathion contamination.

	No. of units	No. of adults	No. of children
Recommended for quarterly biomonitoring	261	588	345
No further action based on initial urine biomonitoring	311	626	498
Second-quarter urine samples	175	382	187
Second-quarter refusals/lost to follow-up	94	189	166
Third-quarter urine samples	81	165	83
Third-quarter refusals/lost to follow-up	79	174	81
Fourth-quarter urine samples	66	135	69
Fourth-quarter refusals/lost to follow-up	21	31	16

**Table 4.** Individuals in Chicago area homes triggering relocation based on morning and evening urine samples.<sup>a</sup>

Age group	Persons who submitted A.M. and/or P.M. urine samples	Persons triggering relocation based on either A.M. or P.M. urine sample	Persons triggering relocation based on A.M. urine sample	Persons triggering relocation based on P.M. urine sample
<1 year	29	19 (66%)	18 (90%) <i>n</i> = 20	16 (84%) <i>n</i> = 19
1–5 years	232	64 (28%)	56 (25%) <i>n</i> = 226	47 (23%) <i>n</i> = 208
6–16 years	549	48 (9%)	33 (6%) <i>n</i> = 538	33 (6%) <i>n</i> = 529
>16 years	1,100	7 (0.6%)	6 (0.6%) <i>n</i> = 1,078	4 (0.4%) <i>n</i> = 1,047
All	1,910	138 (7%)	113 (6%) <i>n</i> = 1,872	100 (5%) <i>n</i> = 1,809

Abbreviations: A.M., morning sample; *n*, number of samples submitted; P.M., evening sample. <sup>a</sup>Age information was available for all but three participants.

**Table 5.** Creatinine-adjusted *p*-nitrophenol summary for individuals in Chicago area homes qualifying for relocation.

Age group	No. of persons	A.M. PNP/CR mean (ppb)	A.M. PNP/CR max (ppb)	P.M. PNP/CR mean (ppb)	P.M. PNP/CR max (ppb)	Protocol for relocation (ppb)
<1 year	19	253 ( <i>n</i> = 17)	1,000	306 ( <i>n</i> = 15)	1,200	$\geq 50$
1–5 years	100	406 ( <i>n</i> = 96)	3,200	367 ( <i>n</i> = 97)	3,415	$\geq 300$
6–16 years	171	206 ( <i>n</i> = 168)	1,700	189 ( <i>n</i> = 169)	1,600	$\geq 300$
>16 years	227	123 ( <i>n</i> = 220)	1,800	116 ( <i>n</i> = 216)	1,800	$\geq 600$

*n*, number of samples.

recall the time of onset of symptoms in relation to the MP application in their homes. Onset of symptoms reportedly occurred immediately after or the same day as the MP application in 28 households. Other responses indicated that symptom onset ranged from 2 days to 2 years after MP application. These symptoms reportedly decreased over time.

Residents of 23 households reported that pets either became ill or died after MP application in their home. Six households indicated a pet died shortly after MP application. Residents from 11 households sought veterinary care for their pets.

## Discussion

**Response challenges.** The Chicago area MP response posed many challenges for the multiagency MP task force. The initial challenge of convening a multiagency task force and defining roles and responsibilities required many meetings and much dialogue between agency representatives. Completion of the "Proposal for para-Nitrophenol Monitoring in Urine to Track Exposure to Methyl Parathion" by the Methyl Parathion Health Sciences Steering Committee provided a protocol for structuring the response and greatly aided the effort to define individual agency roles. Resources for participation in the response were then determined and allocated by each participating agency, and teams were developed. The U.S. EPA and ATSDR provided leadership and direction necessary for the successful operation of the task force.

Limited resources of participating agencies posed a challenge during the 20-month response. Resources normally used for other programs were redirected to characterize the MP contamination in homes and exposure of residents. These resources included staff,

funds, laboratory support, and sampling equipment. The multiagency approach to the MP response helped to reduce the burden of participating agencies and resulted in manageable resource allocation to complete the response.

The high refusal rate for sampling of households potentially contaminated with MP was a difficult problem for the task force. The major concern was the potential exposure of children who resided in households where a parent or guardian refused access to the sampling teams. Legal options that would require property owners to allow access were discussed and explored, but nothing enforceable was developed. Tracking rental units where occupants had refused access was a task force priority. The task force hoped to find a way to ensure that future occupants would be informed that the property may have MP contamination. The Chicago City Council utilized an existing ordinance to require property owners to provide written disclosure of MP contamination and documentation of any remedial work during real estate or rental transactions (4). Disclosure of contamination in Cook County homes outside the Chicago city limits was more difficult. Disclosure of MP contamination fell under the jurisdiction of local city or village government authorities, and no uniform response was developed or enforced by county officials.

The popularity of the illegal PCO contributed to the number of access refusals. Some residents, in refusing to allow sampling, stated their concern for the welfare of the PCO. The PCO had a good reputation in some neighborhoods because customers thought he provided a reliable, effective service at a reasonable price. The conviction and subsequent sentencing of the PCO may have

convinced some residents to reconsider their refusal to grant access.

## Conclusions

As a result of the Chicago area MP response, exposure to MP was reduced and, in most cases, eliminated. Based on self-reporting, exposure to MP resulted in acute symptoms shortly after spraying, but these symptoms did not persist and decreased over time. Long-term health implications of exposure to MP are unknown.

The multiagency task force demonstrated that cooperation between federal, state, and local authorities is possible and can result in an effective public health response. This approach allowed participating agencies to share and to more finely focus existing resources. Of particular advantage was the expertise and oversight provided by ATSDR and the U.S. EPA. The lessons learned and the working relationships developed during the MP response have improved the ability of federal, state, and local government agencies to respond to environmental and public health crises in Illinois.

## REFERENCES AND NOTES

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