Table 1
Known or Suspect Releases of Chemical Agents (Newly published releases in red italics)

Site	Release Assessment	Low-Level Exposure Assessment
Ground-Troop-Induced Releases		
1. Khamisiyah Pit (30 45N 46 26E)	**Definite Release:** US troops performing destruction of conventional munitions unwittingly destroyed nerve-agent-filled 122-mm rockets on 10 March 1991.	**Exposure Likely:** Joint 1997 IC/DoD estimates indicated some US troops probably were exposed to low levels of nerve agent. 2000 DoD modeling using updated release amounts indicates the area affected was reduced by about half, but updated troop locations resulted in an increase in the number of potentially exposed troops.
2. Khamisiyah Bunker 73 (30 46N 46 26E)	**Definite Release:** US troops performing destruction of conventional munitions unwittingly destroyed nerve-agent-filled 122-mm rockets on 4 March 1991.	**Exposure Unlikely:** 1996 CIA modeling indicated no US exposure because winds blew the release away from troops; moreover, we now assess that the amount of agent released was 20 times smaller than previously assessed.
Aerial-Bombing-Induced Releases and Potential Releases		
3. Muhammadiyat Mustard Agent (33 15N 42 41E)	**Definite Release:** Aerial bombing ignited conventional rockets that fell on and ignited mustard bomb crates. The subsequent fire burst some mustard bombs. Bombing occurred on 10, 12, and/or 16 February 1991.	**Exposure Unlikely:** 1996 CIA modeling indicates no exposure of US troops. Our estimate of the amount of mustard agent released has doubled since 1996—driven primarily by the discovery of additional damaged mustard bombs. 2001 DoD modeling with updated release amounts indicates no exposure to US troops.
4. Muhammadiyat Nerve Agent (33 15N 42 41E)	**Likely Release(s):** Coalition bombing probably damaged nerve agent bombs (19 January–24 February 1991), but circumstances of the release are uncertain. Multiple smaller releases are possible.	**Exposure Unlikely**: 1996 CIA modeling showed that low-level contamination did not reach US troops in Saudi Arabia. Moreover, we now assess the amount of agent released is smaller than our 1996 estimate. 2001 DoD modeling with updated release amounts indicates no exposure to US troops (except possibly special operations forces in Iraq according to DoD).
5. Al Muthanna Bunker 2 (33 51N 43 49E)	**Definite Release:** Aerial bombing caused burning of nerve agent rockets on the morning of 8 February 1991.	**Exposure Unlikely:** Previous CIA modeling indicated the resulting low-level nerve agent contamination did not reach US troops. Moreover, our latest estimate indicates the release was 40 times lower than previously modeled. 2001 DoD modeling with updated release amounts indicates no exposure to US troops.
6. *Al Muthanna Mustard Production Building* (33 51N 43 49E)	**Definite Release:** Aerial attacks against a production building in mid-January or early February 1991 released mustard agent. Large chemical agent releases at other Al Muthanna production and filling areas unlikely.	**Exposure Unlikely:** Release not modeled, but extrapolation from previous modeling at other sites suggests the release rate and amount are too low for low-level agent to reach US troops.[a]

Table 1
Known or Suspect Releases of Chemical Agents (Newly published releases in red italics) (*continued*)

Site	Release Assessment	Low-Level Exposure Assessment
Aerial-Bombing-Induced Releases and Potential Releases (continued)		
7. Ukhaydir (32 23N 43 30E)	**Unlikely Release(s):** Two near misses of stacks of 155-mm mustard shells occurred during Coalition bombing on 20 January and 13/14 February 1991.	**No Exposure:** New information suggests that no mustard agent was released; previous CIA modeling already indicated that any contamination would have fallen well short of US troops.
8. *Al Walid* (32 56N 39 45E)	**Suspect Release:** UNSCOM evaluation of its photos indicated some burned alcohol-filled (binary) bombs—probably damaged by Coalition bombing—might have contained nerve agent. Additional information is needed for a release determination.	**Exposure Unlikely**: Suspect release not modeled, but extrapolation from previous modeling at other sites suggests release amount would have been too low for low-level nerve agent to reach US troops.
Incidental Iraqi-Induced Releases or Potential Releases		
9. Burned 155-mm Mustard Shells (Exact location unknown but possible locations include Ukhaydir [probably prewar], the Fallujah Proving Ground, Al Muthanna, roadways between the sites, and the site of a trailer fire. All sites are north of 32 25N.)	**Definite Release:** In September 1991, UNSCOM found 104 burned 155-mm mustard shells at Fallujah Proving Ground—rounds Iraq later admitted were moved there from their wartime deployment at Ukhaydir Depot. Iraqi explanations and UNSCOM assessments still leave the destruction date and location uncertain. We do not know when these munitions were burned, but we believe it most likely was unrelated to Gulf war action.	**Exposure Unlikely:** The release was not modeled, but extrapolation from previous modeling of similar releases at other sites suggests the release amount is too low for low-level mustard agent to reach US troops from even the closest site.
10. *Leaking Munitions and Bulk Storage Containers at Six Sites:* **Al Muthanna** (33 51N 43 49E), **Al Tuz Airbase** (34 56N 44 29E), **Tammuz Airbase** (33 19N 43 35E), **Al Mutasim Airbase** (34 10N 44 15E), **Muhammadiyat** (33 15N 42 41E), **Khamisiyah** (30 46N 46 23E)	**Definite Releases:** UNSCOM indicated that some chemical munitions and bulk containers leaked during storage because of defective design and corrosion. In addition, intelligence and UNSCOM information indicates mustard bombs probably were damaged by Iraqi burial at Al Tuz Airbase in late January or early February .	**Exposure Unlikely:** Slow leaks or intermittent releases from a small number of munitions are unlikely to have caused long-range contamination.

Table 1
Known or Suspect Releases of Chemical Agents (Newly published releases in red italics) (*continued*)

Site	Release Assessment	Low-Level Exposure Assessment
Incidental Iraqi-Induced Releases or Potential Releases *(continued)*		
11. *Iraqi Unilateral Munitions Destruction at Five Sites:* VX-Filled Warheads for for Al Husayn Missiles ***Al Nebai*** (33 41N 44 06E) R-400 Binary Bombs ***Saddam Airbase*** (35 43N 43 16E), ***Qadisiyah Airbase*** (33 48N 42 22E), ***Airfield 37*** (33 27N 42 51E)	**Suspect Releases:** UNSCOM analysis indicates missile warheads were filled with VX nerve agent when destroyed after June 1991, but UNSCOM assessed the VX was totally degraded by then. A small number of R-400 bombs could have been filled with nerve (GB/GF) agent prior to Iraqi destruction, but we cannot determine the outcome without further information.	**Exposure Unlikely:** We have insufficient information to determine if any nerve agent was released. Nevertheless, although these suspected releases were not modeled, extrapolation from previous modeling at other sites suggests the release. amounts are too low for low-level nerve agent to reach troops.

[a] This study examines potential chemical agent exposure to US troops in allied Persian Gulf countries, southern Iraq, and Kuwait. DoD handles potential exposure of special operations forces located elsewhere.