

HEALTH AND MEDICAL RESPONSE TO HUMAN ILLNESS CAUSED
BY KNOWN OR SUSPECTED CHEMICAL AGENTS
North Dakota Department of Health

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See Attachments for Summary of Incident Command Decision Making

Scope of Plan

This plan describes the emergency health and medical response of the North Dakota Department of Health to the known or suspected release of a chemical agent. By “chemical agent” this plan means all material substances (excluding radioactive sources and substances found in food) released into the environment which by their presence and concentration may adversely affect human health. By “release”, this plan refers to the acute introduction of a chemical into the environment with potential immediate consequences to human health. Presence of a chemicals potentially threatening to human health due to long term health effects only is not included.

This plan covers chemical releases with any of the following characteristics:

- a. Intentional or unintentional
- b. Overt or covert
- c. Known or unknown circumstances of release
- d. Triggered by human action or by natural event.

In addition, this plan is exclusively concerned with the medical response (public health and health care) intended to minimize human morbidity and mortality. Specifically it does not include plans related to the environmental response (acute management of the chemical impact on the environment or long term remediation).

During a serious chemical release, both the environmental and medical response would be activated and be managed through the same incident command response. However, not every local release of a chemical is expected to require activation of this plan since some releases pose little threat to human health (albeit they may have a very substantial environmental impact and require activation of the environmental response plan). When an event with a small impact on human health (e.g., very small number of people or low severity) is expected, the local public health and health care system would be expected to mount an adequate medical response.

Detection of Release

The detection of a chemical release with potential threat to human health may occur in any of the following ways:

- a. A chemical release is recognized and reported (included report by terrorist);
- b. Monitoring equipment detects a chemical signal;
- c. Illness among plants or animals suggest that a poisoning agent is present in the environment;
- d. Individuals report abnormal taste of water or an abnormal odor suggesting a chemical release;
- e. Individuals call government offices or poison control to report health symptoms or signs which are suggestive of a chemical agent;
- f. Recognition by one or more health care providers of a clinical syndrome in one or more persons consistent with chemical exposure syndrome;
- g. Routine syndromic surveillance data recognizes an increase in the number of persons reported by health care providers with a specific syndrome suggestive of chemical release.

Attachment 1 provides a list of indications that would suggest that a particular health event might be caused by a chemical agent.

Consistent with these ways in which a chemical release is first detected, NDDoH emergency responders may learn of a release or reports of a potential chemical release requiring a medical response from:

- a. Internal disease surveillance systems;
- b. The Environmental Section of NDDoH;

- c. A local public health department;
- d. A member of the public;
- e. A business;
- f. Local emergency managers or emergency services (fire, police, EMS);
- g. State emergency management (NDDDES);
- h. Poison Control;
- i. A clinician or hospital;
- j. A laboratory;
- k. Another state agency (e.g., Department of Agriculture); or,
- l. A federal agency;
- m. Canadian government or Canadian private entity.

Agent Identification and Initial Response

The medical urgency, potential threat to the public and appropriate medical response are highly dependent on recognition of the specific chemical agent or at least class of the agent associated with the release. When a chemical release is initially recognized through the identification of plant, animal or human illness, the agent causing the illness is typically not known. In some cases it may be unknowable with any specificity (e.g., plume from the burning of complex chemical mixtures). In any release with known or suspected threat to human health the first priorities for action are the immediate separation of populations at risk of exposure from the potential source (evacuation or sheltering in place) and identification of the specific agent or agents. Chemical class may be known or suspected early and may be largely sufficient to guide the immediate response. Early recognition field test results may be helpful but should be considered preliminary, that is, identification may be erroneous or other chemicals may be present in addition to the one(s) detected. Preliminary results are interpreted conservatively, that is, protection of human health is ensured pending confirmation.

Initial agent identification may come from manifests or source labeling, field identification of chemical samples collected by Hazmat or other responders, or a specific class of agents may be suspected based on the symptom complex presenting to clinicians. Attachment 2 lists common chemical syndromes and the agents most likely associated with that syndrome.

No location has an unlimited number of potential agents that could be released into the environment. Releases from an industrial/business source will be limited to the chemicals stored or in use at that site and releases from transportation sources will be limited to the material(s) being transported, which are labeled on the transport container and included in manifests of transportation companies. While a very wide variety of consumer products may be present in many commercial business sites, the quantities are usually small enough that release would be expected to have very localized effects. NDDoH Environmental Health Section will determine what potential chemicals are on site and the potential impact of those chemicals based on the method of release (e.g., impact of release by fire). Intentional releases of chemicals are less likely to have an identifiable source and more likely to include highly toxic chemicals which even in very small quantities may cause illness and death.

Even for a release from a labeled source, it may take time to determine the specific agent and get that information to clinical responders. Clinical response to many substances and particularly the use of antidotes often must be very fast. If the agent is not known, patient care can be guided by the clinical syndrome. Recommendations for immediate clinical care of patients with a chemical exposure due to a known or unknown agent are most rapidly available through poison control centers (1-800-222-1222). Other resources including on-line clinical guidance is provided in the attachments.

Activation of Laboratory Response

In some cases, identification of the specific agent may require collection and processing of environmental samples. The North Dakota state lab will be able to process environmental samples for some types of agents; however, some environmental samples and all biological samples will need to be sent to a laboratory out-of-state. The state lab has placed chemical collection kits around the state and is the default source for information on specimen collection and for specimen receipt, specimen preservation and safe packaging of samples for transport to a reference laboratory. If needed, assistance determining specific biological samples to be taken and tests which may be necessary can be guided by poison control toxicologists. In the event that the processing of samples exceeds the routine capacity of the lab, the lab will activate its surge response plan. The state lab will be in communication the reference lab and ensure that results are provided to the Department Operations Center as soon as they become available.

Veterinary labs may also be able to assist if animal exposure/toxicity is noted. Collection and analysis of animal exposure data will be under the direction of the State Veterinarian.

Notification of Key Partners

As noted above, any level of the response system may receive initial notification of a known or suspected chemical release. The entity first identifying a chemical release with potential to adversely impact human health needs to initiate communications with other parts of emergency response system including clarity regarding who will be responsible for further information dissemination. In any emergency, whether chemical or otherwise, regardless of the point at which the notification enters the public health system (state or local), NDDoH will ensure that the information will be extended to all the potentially impacted parts of the public health system, impacted medical community and state emergency management. In addition, NDDoH will ensure the following additional partners (directly or indirectly via DES or local public health) are notified depending on the particular circumstances of the event:

Responder	Circumstance
Local public health	<ul style="list-style-type: none">• Any event which may affect a local public health jurisdiction
DES	<ul style="list-style-type: none">• Any event with substantial health or environmental impact
Office of Governor	<ul style="list-style-type: none">• Any event which results in activation of the DOC• Any event which has the potential for being reported in large media markets in the state
Law enforcement	<ul style="list-style-type: none">• Any event which is or may be intentional in origin• Any event which may require law enforcement management of perimeters of release• Any event which may involve evacuation of a population• Any event which may require stat transportation of antidotes or specimens
Acute care facilities	<ul style="list-style-type: none">• Any event likely to result in a substantial number of persons seeking health care• Any event which may lead to the movement of a substantial number of patients out of the local hospital catchment area• Any event for which identification of the agent may impact exposure/illness recognition or clinical care
Laboratory	<ul style="list-style-type: none">• Any event which may result in a number of specimens exceeding routine daily processing• Any event which may require specialized diagnostic procedures including shipment to reference laboratories• Any event which places high urgency on the processing of a

	specimen • Any event which may require special handling procedures on arrival in the lab • Any event for which the sampling requires special collection or transportation procedures
DHS	• Any event which may result in evacuation with sheltering requirements • Any event with substantial potential for causing mental distress for patient numbers exceeding usually daily care
CST	• Any event which may be facilitated by the expertise or equipment of the response unit
NDDOT	• Any event which may require DOT assistance with transportation of resources (e.g., large amounts of hospital supplies)
Regional HAZMAT	• Any event which may require mobilization of HAZMAT response in a specific area
Coroners, State Medical Examiner	• Any event with substantial mortality or potential mortality • Any event involving mortality with forensic implications
Department of Agriculture	• Any event which may impact large populations of animals • Any event which result in contamination of food sources • Any event which may require pet sheltering
University of Mary University of North Dakota	• Any event which may require state medical sheltering
Federal agencies (OSHA, EPA, Corps of Engineers)	• Any event which may require their assistance, alter implementation of regulations or impact their infrastructure
CDC/ATSDR	• Any event which may require CDC response or consultation

Identify Preliminary Control Measures

A chemical release which has the potential to impact health will require a determination whether immediate control measures are required to:

- Limit the size of the population exposed;
- Minimize the severity of exposure for those already exposed;
- Limit the spread of the chemical out of the immediate area; or,
- Control food and water consumption due to possible contamination.

It is likely that that a determination or recommendation will be required of public health. As is true in all immediate public health responses, sufficient information may not be available to ensure that the best possible action is taken; therefore, immediate response will be based on the best estimate of the potential risk to populations and tend toward taking conservative action to prevent exposure.

Immediate control measures may encompass the following:

- Sheltering-in-Place or evacuation;
- Monitoring of individuals leaving exposure area;
- Decontamination of people, pets, objects;
- Isolation of food and water supplies which may be contaminated;
- Activation of health care response; and,
- Mobilization of antidotes and preparation of acute care system to receive patients (including self-report with contamination).

Sheltering-in-Place vs. Evacuation

The decision to shelter-in-place or evacuate may be made at the community level or state level. NDDoH may in some circumstances be called upon to assist with that decision, particularly if

questions arise that require judgment of medical impact. Population areas already affected by the release may be treated differently than population areas which have not yet been impacted by the release.

Whether the decision is made to evacuate or shelter-in-place, instructions will need to be provided rapidly to individuals in the impacted area regarding actions they should take or not take. Media messages to shelter-in-place or evacuate may not be recognized by the public during the night, making timely evacuation difficult. Conversely, individuals who are not aware of the event while sleeping will be less likely to evacuate in spite of directions to shelter-in-place. (Some persons told to shelter-in-place are likely to attempt to evacuate the area out of fear, distrust of government or intent to be reunited with family/children about whom they are concerned.) The effectiveness with which disaster responders reach the entire affected public will depend on the available methods for reaching them (e.g., reverse 911).

For a chemical event which creates a plume (respiratory risk), the decision will be based on the following considerations:

- What is the agent or agent class?
- How much geographic area containing how much population is already impacted by the release?
- What areas may become impacted over the next hours? Can those areas be evacuated before the plume arrives?
- Is the release continuing? Are concentrations expected to decline, rise or remain the same?
- Are changes in the weather expected (rain, wind speed and direction, fog) which may ease or worsen the risk of exposure?
- What is the expected tolerance of individuals, healthy or otherwise, to outdoor levels of exposure for the expected length of time it would take for them to move out of the area?
- Will the population be able to move out of the area (e.g., visibility) and how fast can evacuation occur (e.g., population size, exit routes)?
- How safe will the population be sheltering-in-place, with and without specific actions to limit entry of the chemical into the home (e.g., turning off ventilation systems, sealing air entry points)?
- How long is sheltering-in-place likely to be needed?
- What is the likelihood of the population obeying sheltering-in-place instructions (e.g., how noxious is the chemical in very small amounts (e.g., H₂S, ammonia) and how frightening is the chemical likely to be to the public)?
- What highly vulnerable populations are present and how might exposure affect them differently (e.g., lung disease, small children, nursing homes, hospitals) or how might their ability to evacuate rapidly be impaired (e.g., spinal injury, stroke, poverty without access a vehicle)?

Monitoring of Individuals Leaving the Area

Some types of exposure will dictate that only those who have a high level of PPE protection will be able to approach persons who have not received at least gross decontamination; however, some types of exposures may not pose any risk of exposure through the air (non-volatile chemicals, heavy metals) such that monitoring for exposure could be performed by local public health personnel at points outside the hot zone wearing a low level of PPE to prevent physical contact.

Depending on the agent, determination of exposure risk is likely to be dependent on observable facts and the history provided by individuals leaving the exposure area, based on the following:

- Was the person intercepted leaving the hot zone?

- Does the person have obvious contamination or risk factors for contamination such as injury related to proximity to an explosion?
- Where does the individual report having been at the time of the release?
- What type of exposure and how much exposure was possible?
- Did the person sense the chemical agent (e.g., smell, see)
- What was the person's relative elevation in the potential exposure area?
- Does the person have any clinical symptoms suggesting toxicity due to exposure?

Determining individual level exposure using chemical monitoring techniques will rarely be feasible.

Recommendations for evaluating individuals for exposure will be developed and disseminated as quickly as possible. Application of those guidelines will determine what is done with each person, including whether the person undergoes decontamination and whether the person is sent to a health care facility. Note that the absence of symptoms is not a reliable indicator that a person was not exposed. The latent period between exposure and symptom onset is dependent on the agent. For example, exposure to vesicants may not result in symptoms for up to 24 hours. Some persons with potential exposure may insist that they are fine and want to refuse evaluation for exposure and medical observation. Information related to likelihood of exposure may also be used to determine necessity of decontaminating pets; however, individuals will likely have to be separated from their pets to accommodate pet decontamination and pet sheltering. .

Decontamination of Individuals Leaving the Area

The risk to responders assisting with decontamination will depend on the chemical agent(s) involved. If gross decontamination is indicated and the chemical agent poses substantial risk to responders, then only persons wearing adequate PPE will be able to assist with gross contamination. In the absence of immediately available personnel with adequate PPE, the patient can be instructed from a distance in self-decontamination including removal of the outer layer of clothing and washing in a shower.

Community Reception Centers

If a large number of individuals require assessment for exposure and potential decontamination or referral, then management of this process should occur at a Community Reception Center most likely operated by local public health and its allied response partners (Hazmat, EMS, health care). A CRC would contain eight areas:

1. Initial sorting
2. First aid
3. Gross decontamination
4. Final decontamination
5. Registration
6. Exposure assessment
7. Discharge planning
8. Counseling

CONTAMINATION CONTROL ZONE AREAS

1. Initial sorting - Persons arriving at the CRC would be evaluated
 - To identify those in need of immediate medical care with referral to the first aid station if needed
 - To identify persons with likely high level contamination for referral to a gross decontamination or possible low level contamination with referral to final decontamination. (Note: because it may not be possible to determine who is and who

is not contaminated, all person who present from a potential exposure zone may be put through two stage decontamination even if they report having already performed self decontamination.)

- To identify persons in need of special attention so that assistance can be provided.
2. First Aid: Persons would be sent to the First Aid Station if they had any acute medical condition, related or unrelated to chemical exposure. At this station, medical evaluation would be coupled with removal of clothing and removal of any grossly visible contamination on skin or hair. The level of medical care provided at this station would be EMS level.
 3. Gross Decontamination: Sorted by patient sex for privacy, this station would seek to remove most of the contamination which is or might be present by the removal of clothing and removal of any apparent contamination or on skin or hair. Outer clothing removal might be sufficient or may require removal of all clothing. This will likely be determined by the nature of the chemical release. Material used in gross decontamination such as paper, cloth, wash water may need to be contained for later disposal.
 4. Final decontamination: This station would likely depend on showering with soap and water to remove any remaining external traces of chemical. Provision of alternative clothing would be necessary. In cold weather a person may need to be separated from cold weather clothing. Patient circumstances and destination on discharge from the CRC may determine whether the substitution of cold weather clothing of some sort is necessary, especially given that some people may not be able to return to their home for some substantial period of time to obtain new clothing. Persons may need warm transport to a shelter where arrangements can be made for provision of additional clothing.

CLEAN ZONE AREAS

5. Registration: This station would:
 - Determine the likely potential for substantial exposure to the released chemical and need for further exposure assessment;
 - Collect information related to symptoms and signs of exposure;
 - Collect patient information for potential long term tracking in a registry.
6. Exposure assessment: This station would:
 - Determine the need for immediate medical follow-up and provision of acute care or observation;
 - Determine the need for delayed medical follow-up to evaluate long term impact;
 - Determine the need for collection of biological samples to determine the extent of internal contamination;
 - Education of patients who have had a significant exposure regarding short term and long term signs or symptoms of exposure and actions to take if illness develops.
7. Discharge planning: This station would
 - Provide education regarding the current situation's impact on their housing options once they leave the site (e.g., closure of their neighborhood to immediate re-occupation);
 - Determine options for patient disposition which might include discharge to home or to a home of friend or family or to a shelter;
 - Determine need for referral to mental health counseling station.
8. Counseling: This station would be staffed by mental health professionals to provide immediate assessment and counseling and arrange for longer term follow-up if indicated by the patients mental health needs.

Activation of Health Care Response (see health care plan)

Notification of health care institutions likely to receive patients should be made before the arrival of patients at the facility. This would have to come through local responders (e.g., local

emergency management) and happen very quickly since persons at the exposure scene will quickly self present. Early notification can allow hospitals to call in staff, secure resources, cancel or delay non-urgent care, setup decontamination facilities and ensure providers have adequate PPE . However, the amount of information available at the time of initial notification may very limited. Delayed notification may result in an inadequate response, expenditure of resources on those who self-report with lower medical needs than those who arrive subsequently by ambulance, or illness among responders due to lack of awareness of the need for PPE and decon.

Historically, releases of chemicals which cause health effects have been associated with persons rapidly leaving the exposure area and presenting to an emergency room for evaluation. Typically those persons least affected will be able to make it to the hospital first and may be a hospital's first awareness that a chemical release has occurred. Steps a hospital may need to take upon notification of the event include:

- Lockdown of the facility for controlling access to the building, including potential diversion of non-exposed patients to alternate sites;
- Setup of screening points to direct patients;
- Immediate setup of decontamination facility for receiving potentially exposed patients occurs;
- Mobilization of trained individuals to assist with gross decontamination of persons who present to the hospital without prior gross decontamination;
- Management of available resources to ensure that resources go first to those for whom urgent care is most likely to prevent loss of life, limb or organ.

The facility may have to be flexible in its response, pulling back resources being expended on lower priority patients as more seriously ill patients begin to arrive. Facilities will ultimately have to deal with the worried well and minimally injured population as well as mental health impact which may continue for weeks or months after the acute crisis is resolved.

NDDoH and local public health would have primary responsibility for statewide notification of the health care system. Issues which need to be communicated include:

- The nature of the event, its evolution, the suspected agent, the risk of exposed persons being contaminated and potential risk to health care providers.
- Severity and nature of chemical illness (presenting symptoms, latency and illness progression, response to treatment and management recommendations), associated injuries (e.g., explosion) and numbers of persons possibly affected;
- Information needed for accurate exposure assessment;
- Community impact (health care facility impact, evacuation);
- Likely impact on other HCF outside the disaster area;
- Resources available (personnel, equipment, expertise).

NDDoH would also make notifications across political boundaries if that is indicated and make early contact with subject matter experts to help guide the process.

NDDoH would also need information from the health care system including:

- Clinical information from those facilities already treating patients (e.g., symptoms, response);
- Immediate and anticipated needs;
- Bed availability;
- Assistance with coordinating public information release; and,
- EMS availability.

NDDoH would expect to begin mobilization of EMS to the area to transport patients already grossly decontaminated to health care facilities, assist with final decontamination at the receiving hospital and move patients between facilities to minimize surge impact or provide a higher level of care, and assist in evacuation of health care facilities if that is needed. Volunteers (e.g., health care providers) may be needed to support hospital-based care and assist in evacuation transport and sheltering. Volunteer activation takes time and immediate identification of a pool of volunteers and preparing them to mobilize is needed.

In the event a large number of patients have been affected or are likely to be affected clinically, NDDoH would activate a mass surge response. The surge activation would seek to ensure that resources are sufficient to respond to the event across the health care system (including notification across state or international boundaries if indicated) and would be initiated through convening of the health care system via videoconference to include event briefing, understanding potential facility needs and resource activation. Part of the briefing process would be inclusion of information on what to expect related to patient flow. Need for surge response may result in NDDoH activating a federal response if the resources required may exceed state capabilities.

Health care services which will be needed from the private health care sector include:

- Decontamination, especially final decontamination of potentially contaminated patients, but also gross decontamination (e.g., on-site or by patients to a site for gross decontamination).
- Emergency room assessment of patients to determine severity of immediate or delayed illness and need for longitudinal care including inpatient admission;
- Inpatient care including intensive care for those patients most seriously injured;
- Transfer or referral of patients to ease overload on acute care response;
- Counseling of patients about exposure risk including management of worried well;
- Working with the state public health system to ensure adequate health care resources for all patients to receive timely care;
- Working with public communication systems to provide clinical information pertinent to the illness which can be provided to the public;
- Management of long term follow-up past the initial acute care period when late effects of exposure may become manifest; and,
- Recognition of mental illness and provision of mental health care.

Activation of the Chempack

Located within hospitals in six North Dakota cities is a cache of antidote and chemical exposure treatment material which can be rapidly moved to a geographic area in which treatment is needed. Three of these packs are considered EMS packs with materials having predominantly auto-injectors (Jamestown, Dickinson, Minot) and three are hospital packs with bulk material for sustaining treatment of larger populations (Bismarck St. Alexius, Grand Forks Altru, Fargo Sanford Health). Patients who arrive via EMS are likely to have received some exposure treatment; however, the antidotes may be metabolized or excreted prior to complete metabolism or excretion of the chemical exposure agent. Chempack contents are intended to extend that treatment until the patient no longer needs it.

Because chemical agents can act very quickly causing death or serious injury, contents of the chempack must be available rapidly. In the event that a chemical release occurs distant from a hospital in which the a chempack and management drugs are available suitable to the chemical released or suitable to the symptoms which the release has caused, then the chempack (or part of it) may be moved to the more proximal hospital or hospitals. The referral hospitals having the chempacks that are most proximal to the release area are also most likely to receive patients in

transfer and should keep part of the contents of the chempack. Highway Patrol will be used as the transport option for locations relatively close to the nearest chempack. Movement of more distant chempacks toward the patient catchment are may use air transport; however, that will be determined by logistical considerations at the time (incident command decision).

Large releases which exceed state resources would generate a call to the SNS for managed inventory or the DOC may contact a neighboring state for access to chempack materials. Additional medication may be met in part by pharmaceutical wholesalers in the state depending on the drugs that are needed. Veterinary drugs may also be useable; tapping that source may be substantially faster but brings with it off label use complications.

Following the incident, chempack materials will be recovered and returned to the hospital from which they were mobilized.

Isolation of Food and Water

Some chemical releases may result in contamination of food and water supplies. Identification of potential food and water sources in the contaminated area may need to be associated with actions to limit spread of those contaminated sources. Because water flow is difficult to contain, water supply contamination may occur even if water access occurs outside the initial contamination zone (e.g., city water intakes in rivers downstream from the release). The nature of the chemical release will determine the risk of this, both location and characteristics of the chemical (e.g., environmental persistence, solubility, specific gravity). Monitoring for and removal of potentially contaminated sources of food and water from public access may be necessary in addition to notification of persons at potential risk regarding needed actions to avoid exposure.

An additional consequence of a chemical release may be contamination of crops or livestock. The nature of the chemical release will determine whether this poses a risk to the food supply due to residual chemicals entering plants or animals. Restriction on the use of these food sources may be indicated.

If food or water use is restricted, immediate availability of food and water to the population in the area will need to be addressed. Over the short term this may be met with the operation of specific sites for the population to access safe food or water and transport of bulk water to health care institutions and other critical infrastructure; however, if loss of the water supply is likely to be sustained, this could result in evacuation of a greater area outside the immediate contamination zone until safe utilities can be re-established.

Epidemiological Investigation

In many chemical release scenarios, the agent and circumstances of release will be known, and hence, the expected clinical syndrome will also be known. In these circumstances, epidemiological investigation may not be needed. In circumstances when epidemiological investigation is indicated, the Division of Disease Control will have the lead role. The precise nature of the investigation would be situation dependent, but may include the following elements:

- Clarification of the clinical syndrome and identification of likely agent(s);
- Directing collection of samples, especially biological samples, for laboratory analysis and ensuring those samples are moved to the lab.
- Development of screening criteria for use at community reception centers to guide patient management (e.g., further decontamination, acute medical care, shelter, or release to the community). Screening criteria may be based on:

- A defined geographic area of exposure such that persons never in that exposure area might be presumed to be a no risk.
- A defined time period based on what is known about the release, during which exposure must have occurred.
- A set of clinical signs or symptoms which appear to characterize those known or believed to have been exposed, and the timing of those signs or symptoms relative to the exposure;
- Additional signs or symptoms which may not have had time to appear but the appearance of which is likely based on information about the known or presumptive agent or chemical class.

Cases definitions for chemical poisoning can be found at

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5401a1.htm>

(Note: chemical monitoring to assess risk is unlikely to be available to guide decision making regarding exposure risk and exposure management.)

- Assessment of the potential for continuing exposure and assessment of adequacy of control measures to prevent human illness;
- Characterization of the potentially exposed population including its size and population vulnerabilities. The potential exposed population may change over time based on spread of the agent from the area of initial contamination. Determination of environmental spread and immediate response to ensure safety of residents would not be part of the Disease Control responsibility for investigation; however, surveillance-based detection of illness outside the expected exposure zone may be the first indication that the chemical exposure zone is more extensive than initially believed, or at least that contamination has been carried outside the hot zone.
- Identification of cases of human illness (case finding). Cases may be identified through poison control, hotline reports, health care institutions (ER and inpatient), laboratory records and population screening of persons leaving the exposure area.
- Investigation of the nature, source and timeline of release. Actual information collection within the hot zone may need to be done by others trained in the use of the level of protective equipment necessary for safety of the responder at that point in time. NDDoH investigation may depend on interview of both patient and responder with formulation of additional questions to be answered based on what is known about the circumstances and agent. Some of this investigation may involve working closely with environmental specialists and Department of Emergency Services to determine what potential risks were in the area (e.g., fixed sites or transportation of chemicals through the area) which narrow the list of potential exposure agents.;
- Investigation of circumstances of release with determination of intentionality; if risk of intentional release is suggested, this would trigger immediate involvement of law enforcement.
- Determining likely long term consequences including need for medical follow-up and epidemiological tracking through a registry. This is likely to be dependent on the chemicals released and the magnitude of the exposures.
- Collection and management of data related to exposure including patient line listing and laboratory data related to patient exposure. More general data related to the monitoring the release in the environment and modeling would fall under the Environmental Health Section and is outside the scope of the health and medical plan.

Public Information

Details of the operational management of public information can be found in the state public information plan and related regional public information plans. Development of messages for the

public would need to occur rapidly, led by the public information officers within the Department Operations Center. NDDoH public information officers would likely work within the framework of a JIC for state government response, and likely in cooperation with other JICs representing community, health care system and possible federal response.

Immediate messages which would need to be provided to the public would include:

- Immediate action that some or all persons need to take including instructions regarding sheltering-in-place or evacuation;
- What puts a person at risk and how to avoid exposure, including immediate or future risk which might be associated with food or water contamination;
- Geographic areas to be avoided or for which access is restricted;
- How to respond to those who may have been exposed;
- Information re which persons need to seek medical care and which can be reassured that they are not at substantially elevated risk of illness;
- Symptoms associated with the exposure;
- Managing personal exposure including self decontamination;
- Use of personal protective equipment if any is indicated;
- Where to obtain additional information (e.g., news casts, websites and hotline numbers);
- Actions being taken to ensure public safety;
- Alternate sources of food and water if that is indicated.

In the event of a serious chemical release with the potential for a substantial number of people being exposed or concerned that they may have been exposed, NDDoH will activate the hotline (see hotline plan which is part of public information plan).

Worker Protection

Required worker protection will be determined by the event. Selection of the appropriate level of PPE for working directly with a chemical release in the field will be left to the responding unit assigned to work in the hot zone. NDDoH will provide guidance to health care providers (e.g., EMS, receiving facilities) related to the hazardous agent and any risks of exposure through respiratory or dermal contact including contact with patients who may not have been completely decontaminated at the time of arrival at the health care facility. In the face of unknown agents, the likely, or at least potential, agent classes will be used to provide initial guidance to health care providers. Updated guidance will be provided as additional information becomes available.

Health care facilities have received some training related to hazardous material management in health care settings; however, some health care facilities may not be prepared to handle patients who may not be fully decontaminated with some high toxicity agents. NDDoH will attempt to provide guidance for management of those patients, which might include a decision to prevent such patients from entering the health care facility and referring them on to a facility offering a higher level of protection to its responding providers. Once patients have been fully decontaminated, health care workers should be able to attend to them without the use of PPE; however, it should be noted that it will likely not be possible to confirm that a patient as been completely decontaminated.

Health care workers will need to be actively monitored for illness and responders experiencing symptoms will need to be removed from the area. (Note that responders may experience symptoms unrelated to chemical exposure such as becoming overheated in personal protective equipment.) One or more responders becoming ill may be indicative of a problem such as inadequate PPE or inadequate patient decontamination. In addition to concerns about patient

contamination, responders will need to remain aware that buildings and equipment may also become contaminated.

Sheltering

A chemical release may result in evacuation of populations from the exposure area or from areas at potential risk of exposure. Some of these persons may require sheltering until they can return to their homes or until they can find alternative living arrangements. Sheltering of evacuees following a chemical release in most ways will be no different from sheltering of evacuees for any other reason, with a couple of exceptions.

NDDoH would have lead responsibility for medical sheltering for population evacuees, temporary sheltering of patients from evacuated health care institutions and possibly short term sheltering of persons post decontamination. Particularly in cold weather, persons undergoing evacuation may need access to cold weather clothing and warm, non-contaminated transportation.

Some decision rule needs to be in place for the event which ensures that persons who are leaving the area are decontaminated if that is indicated by the event. No person who has the potential to have been contaminated should be allowed into a shelter until they have been fully decontaminated.

Determining whether a person is at risk for contamination will, in most cases, be entirely dependent on the history the person provides. It is quite possible to miss persons who are contaminated because they do not give a history that suggests any risk of exposure.

Symptom development in a shelter setting may be delayed after exposure, depending on the agent. In addition, illness may be an indication of re-contaminated by other persons, the environment or by personal possessions (e.g., re-use of the vehicle they used to come to the decon site before it is decontaminated). It is possible that a person who has been adequately decontaminated could bring into a shelter materials which have not been decontaminated resulting in symptoms in themselves or others. In addition, if persons do develop symptoms suggestive of continued contamination, building contamination may have occurred. This would likely have to be judged based on the pattern of illness since the detection of many chemicals on location will not be feasible.

Persons in a shelter should have a designated place to come for medical evaluation. In addition, the shelter population should be periodically evaluated during the period following last possible exposure for a period of time consistent with the chemical agent's clinical presentation and the risk of spread of the agent outside the release zone. It may be advisable in some events to fill the shelter by areas. That is, newly incoming persons might be sheltered in a separate designated area of the building where they can be observed together and will pose the least risk of exposure of persons who have been in the shelter for some time. As the new area becomes filled, that area would be closed and a different area opened to be filled.

Monitoring for Late Effects

It is expected that most of those persons likely to show late exposure effects would be identified early (due to early symptoms or known high exposure) and observed in a health care institution; however, some individuals may become ill in the shelter due to late effects and need to be transferred to a health care facility.

Monitoring for symptoms of continuing contamination or late effects should be considered separately as an add on to routine shelter monitoring in which person in close proximity may

develop communicable diseases, exacerbations of underlying medical conditions or other problems specific to being in a shelter but independent of the chemical release. Chemical exposure related monitoring should be active rather than passive and may cease after a certain period of time post event when further chemical effects are unlikely to occur in persons heretofore asymptomatic.

Mental Health

Chemical events would be similar to any other disaster in which adverse mental health impacts may arise due to

- Illness or injury;
- Illness, injury or death in a significant other;
- Exposure to mass injury, illness or death or explicit suffering;
- Disaster related stress unrelated to chemical illness (displacement, sheltering stress, worry)
- Responder-related stress (fatigue and performance stress in addition to any of the above).

Surveillance and management of disaster-related mental illness should follow protocols laid down in a mental health plan.

Fatality, Forensic Assessment and Management of Contaminated Remains

Management of fatalities is dealt with in the mass fatality plan. Handling human remains following a chemical release presents some special issues which are summarized here.

- In some chemical release scenarios, the hot zone will represent a crime scene which includes the human remains. Access to the bodies may be tightly restricted by the FBI or other law enforcement officials. Some of the bodies may require an autopsy; however, the North Dakota Medical Examiner's Office is not equipped to handle chemically contaminated remains. Removing remains for autopsy to a qualified site or bringing in special expertise and equipment are both options. The state medical examiner would likely continue in a management role even if forensic data collection makes use of others; however, that decision may rest with law enforcement in an intentional event.
- Preliminary identification of remains with tagging using waterproof materials (i.e., resistant to the decontamination process) needs to occur prior to gross decontamination since the gross decontamination process will remove personal identification (i.e., identifying documents) from the body.
- The ultimate goal is return of bodies to the family for final disposition. Bodies can be decontaminated in most circumstances. If a given circumstance precludes that, the State Health Officer has the authority to manage the remains in a way that prevents them from becoming a health hazard.
- Knowing that a body is adequately decontaminated is difficult because chemical monitoring is time consuming, expensive and requires specific high tech equipment.
- Internal contamination is not usually a concern. Chemicals should be bound into the tissues.
- Embalming can be done but it may result in displacement of some chemical onto the surface of the body. This may pose a hazard to morticians, requiring embalming using special PPE. Typically morticians are reluctant to accept bodies that were chemically contaminated even if adequate decontamination is known to have occurred. NDDoH will need to provide guidance to morticians handling bodies related to risk of embalming.
- Embalming fluid will react with bleach (which may be used in the decontamination process) to produce chlorine gas. Embalming and decontamination must be done in separate areas.
- Bodies which can safely be turned over to a mortician can be buried using standard protocols. More hazardous remains may require that the casket be sealed. Morticians may not know how to seal a casket or may open them after they are sealed if not otherwise instructed.

- Cremation is a safe alternative for chemically contaminated remains. Chemicals are destroyed at the temperatures used for cremation (e.g., 1000°). Routine preparation for possible cremation of chemically contaminated bodies before embalming occurs is recommended (e.g., removing of foreign devices like pacemakers) even though disposition by cremation may not have been determined by that time.

Disaster management of remains may also include animal remains. This is outside the scope of this document.

Environmental Decontamination

Methods of environmental decontamination are beyond the scope of this document; however, public health will need to determine appropriately PPE for entering an area over time as the hazard is likely to lessen naturally over time. Targeted remediation may have to be completed before public health determines that the area can be re-occupied. Until such time as an area has been determined to be safe for re-occupation, access to it will need to be restricted.

Pre-Event Public Education

In depth education of the public pre-event will be of limited utility for most populations; lack of interest typically dooms such attempts. Attempts at education of the entire public related to sheltering-in-place and evacuation response may save lives. For populations which are proximal to sources of that could pose chemical exposure risk, detailed education is reasonable.

Attachment 1

Epidemiologic clues to recognition of chemical associated illness

- **Rapid onset of symptoms following exposure:** e.g., Nausea, vomiting, headache, burning sensations and/or paralysis within minutes of eating.
- **Unusual groupings or pairings of symptoms:** e.g., Gastrointestinal symptoms and neurologic effects in the same patient or a clinical presentation of acidosis and altered mental status.
- **Failure to respond to usual therapy:** Severity or prognosis of illness differs from the course of an apparently common illness (e.g., Non-resolving viral GI illness or abdominal cramping progressing to multi-organ system failure).
- **Higher morbidity or mortality than expected with common illness**
- **Altered taste/appearance of contaminated medium:** e.g., Reports of food with a metallic or burning taste; discolored or odorous drinking or recreation waters.
- **Environmental considerations:** e.g., Unusual pattern of death or illness among plants or animals. Unusual or distinctive odors or discoloration observed and reported.

Attachment 2

Clinical Syndromes and Potential Chemical Causes

Source: Chemical Illness Response Guidelines for Public Health Investigations of Acute Onset Illness Clusters of Chemical Etiology, Michigan Department of Community Health

Clinical Syndrome	Signs and Symptoms	Potential Chemical Etiologies
Cholinergic crisis	<ul style="list-style-type: none"> • Salivation, diarrhea, lacrimation, bronchorrhea, diaphoresis, urination, bradycardia, hypotension 	<ul style="list-style-type: none"> • Nicotine • Organophosphate insecticides - Decreased acetylcholinesterase activity • Muscarine poisoning (e.g., Clitocybe and Inocybe mushrooms)
	<ul style="list-style-type: none"> • Miosis, fasciculations, weakness, bradycardia or tachycardia, hypotension or hypertension, altered mental status, seizures 	<ul style="list-style-type: none"> • Carbamate insecticides • Medical carbamates (e.g., Physostigmine)
Cellular hypoxia	<ul style="list-style-type: none"> • Airway toxicity: Cough, hoarseness, dyspnea, chest tightness, hemoptysis, dizziness, wheezing or rales, cyanosis, hypoxemia, pulmonary edema 	<ul style="list-style-type: none"> • Phosgene • Ricin • Ammonia • Chlorine • Phosphine - Mitochondrial toxicity • Nitrogen oxides • Organofluorine (Teflon) pyrolysis
	<ul style="list-style-type: none"> • Hemoglobin toxicity with cyanosis: Nausea, headache, dizziness, dyspnea, confusion, coma, convulsions 	<ul style="list-style-type: none"> • Methemoglobinemia-causing agents (e.g., sodium nitrite)
	<ul style="list-style-type: none"> • Hemoglobin toxicity without cyanosis: Nausea, vomiting, headache, dizziness, weakness, dyspnea, confusion, syncope, coma, convulsions, dysrhythmias, cardiovascular collapse 	<ul style="list-style-type: none"> • Carbon monoxide
	<ul style="list-style-type: none"> • Mitochondrial toxicity: Mild (nausea, vomiting, headache), severe (altered mental status, dyspnea, hypotension, seizures, metabolic acidosis) 	<ul style="list-style-type: none"> • Sodium monofluoroacetate - Hypocalcemia, hypokalemia, • Cyanide • Carbon monoxide • Hydrogen sulfide • Sodium azide • Phosphine - Respiratory tract irritant
Severe gastrointestinal illness, dehydration	<ul style="list-style-type: none"> • Abdominal pain, vomiting, profuse diarrhea (possibly bloody), hypotension, possibly followed by multisystem organ failure 	<ul style="list-style-type: none"> • Arsenic • Colchicine • Ricin - Inhalation of an additional route of exposure; severe respiratory illness possible • Barium - Hypokalemia, arrhythmias, and paresis common • Cyclopeptide poisoning (e.g., Amanita and Galerina mushrooms) • Monomethylhydrazine poisoning (eg, Gyromitra mushrooms) • Shigatoxin (e.g., ground beef, raw vegetables) • Ciguatoxin poisoning (e.g., tropical reef fish) - associated sweating, headache, and muscle aches • Amnesic shellfish poisoning (e.g., mussels) - associated headache, disorientation, permanent short term memory loss, seizures, paralysis in severe cases

Peripheral neuropathy and/or neurocognitive effects	<ul style="list-style-type: none"> • Peripheral neuropathy including, muscle weakness, atrophy, "glove and stocking" sensory loss, depressed or absent deep tendon reflexes • Neurocognitive effects including, memory loss, delirium, ataxia, encephalopathy 	<ul style="list-style-type: none"> • Methyl bormide (fumigant, toxic gas) - encephalopathy, ocular disturbances, respiratory tract irritation • Mercury (organic) - Visual disturbances, paresthesia, ataxia • Arsenic (inorganic) - Delirium, peripheral neuropathy • Thallium - Delirium, peripheral neuropathy • Lead - Encephalopathy • Hexane - Peripheral neuropathy • Acrylamide - Encephalopathy, peripheral neuropathy
	<ul style="list-style-type: none"> • Paresthesias of face or mouth/arms/legs, headache, dizziness, nausea and muscle incoordination 	<ul style="list-style-type: none"> • Paralytic shellfish poisoning (e.g., "red tide" associated mussels, cockles, clams, oysters, crabs, lobsters) • Tetrodotoxin (e.g., pufferfish) - Paralysis, loss of consciousness and respiratory failure • Neurotoxic shellfish poisoning (e.g., oysters, clams, mussels)
	<ul style="list-style-type: none"> • Diffuse weakness; proximal > distal dysphagia, dysarthria, ptosis, extra-ocular muscle weakness 	Botulism toxin (e.g., home canned foods, garlic in oil)
	<ul style="list-style-type: none"> • Inebriation, hallucinations, manic behavior, delirium, deep sleep 	<ul style="list-style-type: none"> • Ibotenic acid-musimol poisoning (e.g., Amanita and Tricholoma mushrooms) • Psilocybin poisoning (e.g., Psilocybe and other mushrooms)
Generalized muscle rigidity	<ul style="list-style-type: none"> • Seizure-like, generalize muscle contractions, painful spasms (neck and limbs); tachycardia and hypertension are common 	Strychnine - Intact sensorium
Convulsions	<ul style="list-style-type: none"> • Convulsions are a predominant or a primary feature of poisoning with these agents (i.e., a direct CNS effect and not as a secondary effect such as cellular hypoxia) 	<ul style="list-style-type: none"> • Tetramine (Du-shu-quiang) • Hydrazine • Camphor • Organochlorides (e.g., Lindane) • Picrotoxin • Pyrethrin and pyrethroids • Plants (e.g., water hemlock)
Oropharyngeal pain and ulcerations	<ul style="list-style-type: none"> • Lip, mouth, and pharyngeal ulcerations and burning pain 	<ul style="list-style-type: none"> • Diquat • Caustics (acids and alkalis) • Metal salts, Mustards (e.g., sulfur) • Paraquat - Dyspnea and hemoptysis secondary to pulmonary edema or hemorrhage; can progress to pulmonary fibrosis over days to weeks
Nonimmune-mediated hemolysis	<ul style="list-style-type: none"> • Symptoms caused by massive hemolysis: malaise, dyspnea, hemoglobinuria (reddish, heme-positive urine that is often acellular), bronze discoloration of skin 	<ul style="list-style-type: none"> • Arsine (toxic industrial gas) • Dinitrophenols • Chlorates and bromates • Acetic acid • Copper sulfate - Severe gastrointestinal illness is the predominant presentation
Histimine release	Rash, diarrhea, flushing, sweating, headache, vomiting	Scrombotoxic fish poisoning (e.g., tuna, mackerel, bonito)

Attachment 3
Incident Command Decision Making

The following summarizes sequenced incident command action with the provision that some variation in order is likely to occur among incidents.

1. Activation of incident command including state partners.
2. Accessing preliminary information related to chemical agent or agents, size, source and location of release.
3. Emergency health care notifications including EMS services and acute care facilities, including likelihood of seeing patients, nature of the agent, likely clinical presentation and acute management.
4. Emergency public information informing persons in and around the exposure area of actions to be taken or not taken, including support for determining whether sheltering in place or evacuation is indicated.
5. Mobilization of chempacks if indicated and mobilization of state or federal medical supplies or other pharmaceuticals and PPE.
6. Assessment of health care institutions that may be at risk and need to be evacuated.
7. Notification of LPHU.
8. Responder safety planning.
9. Assessment of local actions taken to limit spread, control access and ensure adequate personal decontamination.
10. Material and assistance mobilization for mass screening and decontamination if indicated, including provision of substitute clothing.
11. Ensuring adequate medical transport, including protection of EMS personnel.
12. Assessment of the extent of illness and likelihood of overwhelming the regional health care response.
13. Development of clinical and epidemiological case definition.
14. Provision of clinical information to providers about appropriate care of chemically exposed persons.
15. Assessment of resource availability including beds, expertise, and medication for treatment of exposure syndrome.
16. Ongoing assessment of health system response and mobilization of medical volunteers if indicated.
17. Mobilization of material and sites for medical sheltering if indicated, and setting up shelter triage and disease surveillance.
18. Initiation of epidemiological assessment.
19. Notification of law enforcement if determined to be a possible intentional release.
20. Establish of clinical exposure syndrome surveillance.
21. Environmental assessment of impact area including monitoring, plume modeling and definitive identification of the chemical involved if unknown (e.g., specimen collection, laboratory response, specimen transport).
22. Cross border notifications if indicated.
23. Assessment of mass fatality impact and initiation of definitive mass fatality management, including final disposition of bodies.
24. Initiate assessment of environmental contamination outside of the initial impact area.
25. Additional federal agency notification if indicated.
26. Release of more extensive public information, and coordination of information release with state JIC and local community and health care facility public information.
27. Assessment of possible food (including agriculture) and water contamination and control of contamination if any, and ensuring adequate clean food and water for all populations.
28. Tracking field responders for potential exposure.
29. Surveillance for symptoms among responding health care workers, including long term registry if indicated.
30. Social service involvement for displaced individuals and acute mental health clinical care.
31. Collection information on exposed individuals for long term impact monitoring.
32. Provision of information to mortuaries.
33. Mental health impact assessment
34. Health care system recovery.
35. Environmental remediation.

36. Restoration of cache materials.

37. **Attachment 4:**

RESOURCES

- 2008 Emergency Response Guidebook: Manual for responding to chemical events including identification numbers for chemicals, response recommendations, safety precautions, and safe distances for evacuation. Electronic document available at http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/erg2008_eng.pdf
- NIOSH Pocket Guide to Chemical Hazards: Industrial hygiene information related to several hundred chemicals. Download at <http://www.cdc.gov/niosh/npg/>
- CAMEO computer program: Chemical database, chemical interactions, and tools for tracking chemical inventories. Available at: <http://www.epa.gov/oem/content/cameo/cameo.htm>
- CHEMTREC – telephone-based chemical response assistance site (service of the American Chemistry Council). 1-800-262-8200
- Chem-tel – telephone-based chemical response assistance site subscriber service supported by industry – 1-888-255-3924
- Infotrac – telephone-based chemical response assistance 1-800-535-5053
- Minnesota Poison Control 1-800-222-1222 <http://www.mnpoison.org/>
- National Response Center (US Coast Guard Managed) Chemical spill reporting: 202-267-2675, notifies other federal agencies of event. <http://www.nrc.uscg.mil/nrchp.html>
- Chemical poisoning case definitions:
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5401a1.htm>
- Medical Management Guidelines – clinical information on recognition and management of acute chemical exposures, searchable by chemical. <http://www.atsdr.cdc.gov/MMG/index.asp>
- Managing Hazardous Material Incidents – Training materials for clinical responders. <http://www.atsdr.cdc.gov/MHMI/index.asp#bookmark05>
- Guidelines for Mass Fatality Management During Terrorist Incidents
http://www.ecbc.army.mil/downloads/cwirp/ECBC_guidelines_mass_fatality_mgmt.pdf
- Jane’s Chem-Bio Handbook: Book (for purchase)