

Public Health Management of Facility Related Exposure to Live Polioviruses

Interim guidance in managing exposed persons for countries hosting facilities that maintain live polioviruses

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**World Health
Organization**

Abbreviations

CC	Certificate of Containment
- ICC:	Interim Certificate of Containment
CCS	Containment Certification Scheme to support GAPIII
CP	Certificate of Participation
GAPIII	Global Action Plan for Poliovirus Containment to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use
GCC	Global Commission for the Certification of the Eradication of Poliomyelitis
GPEI	Global Polio Eradication Initiative
GPLN	Global Polio Laboratory Network
IHR	International Health Regulations 2005
- NFP:	IHR National Focal Point
IPV	Inactivated polio vaccine
NAC	National Authority for Containment
OPV	Oral polio vaccine
PEESP	Polio Eradication and Endgame Strategic Plan 2013-2018
PEF	Poliovirus-Essential Facility
PIM	Potentially infectious material for poliovirus
PV	Poliovirus (PV1 is PV type 1, PV2 is PV type 2 and PV3 is PV type 3)
SL	Sabin or Sabin-like poliovirus
VDPV	Vaccine-derived poliovirus
WPV	Wild poliovirus (WPV1, WPV2 and WPV3)

Preamble

This guidance was developed by the Polio Eradication Department of the World Health Organization, Geneva, Switzerland. This is a novel and evolving area of work, as eradication of all wild polioviruses approaches and the need to contain them grows, and therefore this guidance is considered interim. Feedback and comments are welcome and should be sent to Dr Graham Tallis by email to tallisg@who.int and Dr Daphne Moffett moffettd@who.int.

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1. **Background**

The eradication of all wild polioviruses is approaching. Wild poliovirus type 2 (WPV2) was declared eradicated in 2015 by the Global Commission for the Certification of Poliomyelitis Eradication (GCC). Transmission of WPV3 has not been detected since November 2012, and WPV1 has only been detected in three countries since 2015: Afghanistan, Pakistan, and Nigeria.

Under the Polio Eradication and Endgame Strategic Plan (PEESP) 2013-2018, endorsed by the World Health Assembly, once all wild poliovirus (WPV) transmission has ceased, use of oral polio vaccines (OPV) containing attenuated live Sabin viruses will cease. This is taking place in a staged manner, commencing with type 2 virus. The eradication of WPV2 made it possible to withdraw the type 2 component from oral polio vaccine (OPV) from immunization programs in 2016, to reduce the likelihood of vaccine-derived poliovirus (VDPV) emerging, particularly in areas of poor population immunity.

The safe containment of eradicated polioviruses is a key objective of the PEESP 2013-2018. This objective aims to ensure that all unneeded poliovirus (PV) stocks are destroyed; where needed for a critical national or international function¹, such as vaccine production, surveillance and research, polioviruses must be safely and securely contained to minimize the risk of reintroducing these viruses into the population and consequently the re-emergence of poliomyelitis. The *“Global Action Plan for Poliovirus Containment to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use”* (GAPIII)² describes the necessary conditions for containment of needed stocks in poliovirus-essential facilities (PEF)³.

A facility-associated poliovirus infection or release into the environment during the period following eradication use will be a significant public health event with international implications.

The guidance is based on a risk management approach for biological emergencies that recognizes that:

- a poliovirus release or containment breach will occur infrequently;
- the potential public health impact may be very high if transmission becomes established;
- the evidence base for decision making is limited and evolving; and
- community concern about a facility breach may be disproportionate to the level of risk.

2. **Purpose of this Document**

This document has been prepared primarily for countries hosting a PEF, to provide guidance for response to a human exposure or infection related to a known spill or breach of containment involving any poliovirus (PV), whether a wild poliovirus (WPV), vaccine-derived poliovirus (VDPV) or Sabin or Sabin-like virus (SL), from any PEF. The paradigm assumed in the development of this guidance is that the recommended stringent measures are justified in relation to an eradicated (or soon to be eradicated) organism, insofar that every relevant public health measure should be taken to reduce the risk as far as possible that an exposure results in re-established community transmission. Given the very large financial and human resources (including deaths of polio vaccination workers) invested in WPV eradication, and the risk of reversal of progress caused by an accidental exposure or containment breach, the stringent isolation of exposed or infected individuals and quarantine of at-risk contacts is considered justified and proportionate to this risk.

¹ Including Salk-IPV and Sabin IPV production, the development and storage of oral polio vaccine stockpiles, vaccine quality assurance, diagnostic reagent production, virus diagnostic and reference functions, and crucial research.

² WHO Global Action Plan to minimize poliovirus facility-associated risk after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use (available at: <http://polioeradication.org/polio-today/preparing-for-a-polio-free-world/containment/containment-resources/>)

³ A facility designated by the ministry of health or another designated national body or authority as serving critical national or international functions that involve the handling and storage of needed poliovirus infectious materials or potentially infectious materials under conditions set out in GAPIII

This guidance is also useful for any country where a human has been exposed to a poliovirus resulting from a spill in a laboratory or other setting where polioviruses are stored or handled. It is not intended to provide guidance to countries where natural exposure has occurred to a poliovirus which is still circulating in the community in that country (or another country if there is a PV importation).

The application of these measures by a country will depend heavily on their regulatory framework regarding biological hazards. As a matter of legal preparedness, countries that plan to host a PEF should review whether their public health powers are sufficient to isolate a person known or suspected to be infected with an eradicated organism to prevent them from transmitting the infection, thereby becoming a risk to public health. Another pre-requisite is access to the recommended diagnostic testing, which should be in a GPLN accredited laboratory, preferably within the country, as in the future international transport of eradicated polioviruses may become challenging. Where the arrangements for implementation of this guidance are lacking, measures should be taken to address the gaps, or alternatively reconsider the wisdom or value of hosting a PEF. Furthermore, legal preparedness should include preparation for instances of non-compliance, such as when an infected person refuses or evades proper isolation. Appropriate sanctions will need to be applied, proportionate to the risk involved.

PEFs may wish to consider including provisions about the possibility of the need for isolation of employees exposed to PV in their employment conditions, and consider including aspects of this guidance in staff orientations and training programs.

3. Definitions

A PV exposure is considered to occur when a human comes into direct contact with a PV, through ingestion, inhalation or skin contact. For contained PV, this may result in a breach of containment if it results in the virus no longer being confined within the defined, controlled space that is considered the containment zone. GAPIII requires primary safeguards (to prevent infection and release of contaminated materials), secondary safeguards (population immunity in the country hosting the facility), and tertiary safeguards (domestic and environmental hygiene standards) to be in place for containment.

The probability of recognizing that a PV exposure has occurred will depend on several key factors, such as:

- whether the virus is neuropathic (WPV and vaccine-derived poliovirus) and therefore paralyzing or attenuated (Sabin or SL);
- whether there is a known incident leading to PV exposure or a containment breach identified at the time of its occurrence, or a presumed breach is identified through either a human case or environmental isolation, implying delayed detection and response;
- the volume and concentration of virus to which the person is exposed, with the highest potential risk being from facilities routinely working with larger volumes of viral material such as vaccine manufacturers, to none or negligible in an exposure that involves only potentially infectious material as defined in GAPIII.

In this document, a **PV exposure** is any facility accident that potentially exposes humans to any PV, whereas **PV breach** will refer specifically to a release from a PEF of a PV subject to containment, now or in the future, under GAPIII.

In keeping with the definitions used in the IHR 2005, **isolation** in this document refers to separation of infected or contaminated persons, i.e. the person who has been directly exposed to a PV, while **quarantine** refers to separation of their contacts, to pre-emptively remove the risk of further transmission. Notwithstanding use of these terms, this document recognizes that they may have specific legal definitions in some countries and that specific legal authority may be required to enforce isolation or quarantine.

4. Scope of the Guidance

As stated earlier, the guidance is primarily aimed at countries hosting PEFs, but may be useful in other countries, depending on national regulation and the ability to implement the measures.

4.1 Scope of the event response

The scope of the response is limited to the initial public health management of a human exposure and/or infection due to a known accidental poliovirus (PV) exposure or containment breach or intentional release, including management of contacts. In some circumstances, the guidance may be applied where human infection is detected for which there is evidence that the infection occurred because of an unrecognized containment breach; for example, if WPV2 infection is detected in a worker at a PEF, even when no breach is known to have occurred, the response could follow this guidance if sustained transmission has not yet been identified.

If there is evidence or likelihood of sustained transmission, then the relevant document is the standard operating procedure for outbreak management (see SOP <http://polioeradication.org/polio-today/polio-now/outbreak-preparedness-response/>).

For guidance on diagnostic procedures to be used, please refer to the GPLN 'Diagnostic procedures following accidental exposure to polioviruses' which can be found at: <http://polioeradication.org/tools-and-library/policy-reports/gpln-publications/>.

This guidance does not cover the environmental management or 'clean-up' of a spill within a facility. However, at the country and facility levels this guidance should be implemented and linked to the preparedness plan and emergency protocol set up by the facility in case of an accidental or intentional PV release that occurs inside the facility. This guidance elaborates on aspects of GAPIII biorisk management elements 9 (health care), 10 (emergency response and contingency planning) and 11 (accident/incident investigation) in annexes 2 and 3.

4.2 Virological scope

The measures in this guidance must be applied to all PVs that are required to be contained in a PEF according to the implementation phases of GAPIII. As at February 2019, this is limited to PV2, but in the future will apply to PV1 and PV3. Nevertheless, depending on national policies, it is recommended this guidance also be applied for exposures to other PVs, particularly wild polioviruses and VDPVs, as outlined below.

PV2:

WPV2 and VDPV2 are currently subject to containment in PEFs as agreed by the World Health Assembly. The most stringent measures in these guidelines are applied to exposures or infections, or containment breaches, involving any WPV2, as an eradicated organism. In most circumstances, exposures, infections or containment breaches involving VDPV2 will be considered the same as for WPV2, but there may need to be further discussion if there is already ongoing circulation of VDPV2 in the country. Similarly, in many countries stringent measures should be applied to SL2 as well, as global completion of Phase I (inventory, destruction and preparation for the containment of PV2) of GAPIII approaches. However, if mOPV2 has been used in the country because of an outbreak of cVDPV2, an event involving SL2 may not require implementation of this guidance, depending on the risk assessment that considers the geographic scope and time since use of mOPV2.

Globally, as population intestinal immunity to PV2 wanes in previously OPV2-using countries where the IPV

coverage is sub-optimal, and as the size of the cohort of children born after the tOPV to bOPV switch increases, the risk of a rapidly evolving PV2 outbreak increases if a containment breach results in community transmission.

This guidance may also be applied to unexpected situations where exposure to PV2 has occurred outside a PEF, such as a technician in a polio diagnostic lab, where the sample had leaked or been incorrectly packaged and opened outside of a biosafety cabinet, and where the sample was subsequently found to contain PV2.

PV1 and PV3:

WPV1 and WPV3 will be required to be contained according to GAPIII once transmission has ceased and prior to global certification of WPV eradication. However, the measures in this guidance also are recommended to be applied during any spill or release that threatens global polio eradication. For example, transmission of WPV3 has not been detected since November 2012, so any spill or release involving WPV3 also requires a vigorous response, as re-establishment of WPV3 circulation would also set back polio eradication. Similarly, releases involving WPV1 in non-endemic countries should also result in a vigorous response. These measures do not apply to spills or releases of SL1 or SL3 at this time as these viruses are common globally due to widespread use of bOPV; the measures will apply to these viruses after OPV cessation and final containment of all polioviruses.

Potentially Infectious Material (PIM):

Faecal, respiratory, concentrated sewage samples or derivatives of such samples may be potentially infectious for PV if they have been stored under conditions that maintain the viability of PV. If these samples were collected in a place and at a time when WPV or VDPV was in circulation, they are WPV/VDPV PIM and are subject to the full containment described in GAPIII, annex 2, and will need to be stored and handled in a PEF. If WPV/VDPV were not in circulation, but OPV was in use, these samples are OPV/Sabin PIM and may only be handled outside a PEF under certain conditions, described in 'Guidance to Minimize Risks for Facilities Collecting, Handling or Storing Materials Potentially Infectious for Polioviruses'⁴.

4.3 Exclusions

The measures in this guidance may or may not apply to PV exposures in countries or sub-national areas where the particular virus that has been released or spilt is already circulating or presumed to be circulating. The polio status of countries can be found at www.polioeradication.org.

For example, as at February 2019, infected countries are as follows:

- WPV1 – Afghanistan, Nigeria, Pakistan
- VDPV1 – Papua New Guinea
- VDPV2 – DR Congo, Kenya, Nigeria, Somalia, Niger and Mozambique
- VDPV3 – Somalia

Of these countries, only Pakistan is proposing to host a PEF. A hypothetical release of WPV2 (or WPV3 as recommended above) from this PEF would be managed according to this guidance, whereas a release of WPV1 would be managed according to existing national protocols.

A containment breach involving SL2 in any country that has used mOPV2 in the preceding 12 months may possibly be excluded from implementation of these measures, depending on the risk assessment that

⁴ See <http://polioeradication.org/wp-content/uploads/2018/04/polio-containment-guidance-for-non-poliovirus-facilities-20180410-en.pdf>

considers the geographic scope of the use of mOPV2.

Where a breach involves multiple polioviruses, the response should be according to the highest-risk virus (see section 8 below).

5 Roles and Responsibilities

5.1 Roles

The roles and responsibilities may vary according to the structure and legislative powers of the country, but in general the following need to be considered:

- National public health authority: reporting to WHO (see below), national coordination of an event, declaration of national public health emergency (if required), PV event response planning, including ensuring response to a containment breach is included in the polio outbreak response plan, testing the plan, oversight of isolation and quarantine powers.
- Sub-national and / or local public health authority, in cooperation with the national public health authority: implementation of the measures, including isolation of exposed and infected persons, quarantine of contacts, incorporation of a containment breach in local response planning (if PEF located in the area), declaration of a sub-national public health emergency. Also responsible for specimen collection and transport to a GPLN accredited laboratory according to WHO regulations for specimen transport of dangerous goods.
- National authority for containment (NACs) in countries hosting PEFs: certification of a PEF, investigation of breaches (refer to CCS), reassessment of PEF certification status, re-certification of a PEF (if applicable and appropriate), oversight of the re-establishment of containment.
- GPLN accredited laboratory, preferably within the country, is responsible for sample receipt and testing.
- World Health Organization: receives notification, communicates with Member States as necessary, assesses risk of transmission and impact on certification of polio free status, where applicable, and provides technical assistance and support as required.
- Regional / Global Certification Commission: review breach events and their consequences in the light of the impact on the polio-free status of the WHO Region concerned.

5.2 Target audience

The target audiences for this guidance are those who will implement the measures, including:

- national and sub-national and / or local public health authorities, and any other health agency under their jurisdiction including health centers, hospitals or quarantine centers;
- any facilities handling PV and their designated biosafety officer, management and occupational health staff;
- NACs where one exists;
- Diagnostic laboratories should be aware of the guidance and apply the associated GPLN guidance on the same issue (refer section 4.1).

Other audiences that may need to be aware of the guidance include:

- other government agencies, such as environmental management, laboratory regulators etc.;
- WHO Regional Offices and Country Offices;

5.3 Reporting

The International Health Regulations 2005 (IHR) provide the legal framework for reporting of public health events involving polioviruses.

Cases or environmental detection (WPV, VDPV, SL2)

According to annex 2 of the IHR 2005, any case of polio due to wild poliovirus shall be notified by the IHR national focal point (NFP) to the WHO Regional Contact Point under the IHR immediately (normally no later than 24 hours after detection of the event). According to the IHR case definition⁵, this requirement extends to any VDPV case or VDPV environmental detection, and since global OPV2 withdrawal in 2016, any SL2 viruses in humans or the environment.

Spills, releases or breaches (without known or demonstrated human transmission or environmental contamination)

PV2

Because WPV2 has been eradicated, OPV2 has been withdrawn, and all PV2 are currently being targeted for destruction, transfer, or containment in a secure poliovirus essential facility, any PV2 exposure or breach should also be regarded as a notifiable event that may constitute a public health emergency of international concern (PHEIC) according to annex 2 of the IHR 2005, and therefore notified by the IHR NFP to the WHO Regional Contact.

PV1, PV3

Spills or releases involving PV1 or PV3 may also be notifiable according to annex 2 of the IHR, if the event meets at least two of the following criteria:

1. Is the public health impact of the event serious?
2. Is the event unusual or unexpected?
3. Is there a significant risk of international spread?
4. Is there a significant risk of international travel or trade restrictions?

For further advice on interpretation of these questions, refer to annex 2 of the IHR 2005 available at: <http://www.who.int/ihr/9789241596664/en/>. In general, any containment breach involving WPV / VDPV type 1 and type 3 should also be notified to WHO.

When a facility identifies a breach at the time it is occurring, it is the responsibility of the facility management to immediately (as soon as possible, and no later than 24 hours) inform the appropriate public health authority in the country of the breach event. The communication channel put in place should be clearly set out in the facility's Emergency Response and Contingency Plan, and involve any relevant level of government or administrative authority. It is then the responsibility of the national public health authority to notify WHO via the IHR NFP as per normal arrangements under the IHR.

WHO as secretariat will inform the Global Certification Commission (GCC).

5.4 Event management and coordination

Formation of a single incident management team under appropriate authority and with well-defined roles and responsibilities is strongly advised, as all parties must coordinate these efforts strongly to avoid overlap, gaps, or conflicting efforts.

At the national level, the overall implementation of this guidance is the responsibility of the national public health authorities, including management of any cases, contacts or environmental contamination and

⁵ http://www.who.int/ihr/Case_Definitions.pdf

enhanced surveillance. The national protocol should outline the role of local, regional, and national public health authorities in each aspect of the investigation, response and control strategies.

The facility management is responsible for the immediate institutional response to the breach following their emergency response and contingency plan required under GAP III, such as providing first aid or decontamination of exposed workers or visitors, and any longer-term rectification required, including corrective and preventative measures.

The NAC, where one is established, is primarily responsible for oversight of the investigation of root causes leading to the breach, and deciding in collaboration with the GCC if the facility's certification should be suspended or withdrawn. If the event triggers an audit of the facility, GCC may request an independent auditor to join the national audit team.

For any breach notifiable under the IHR, WHO must be informed and involved in the response as per the relevant articles of the IHR (IHR PART II – Information and Public Health Response).

6 Overview of Control Strategies

Control strategies in this guidance are based on standard measures for polio cases, stratified by assessed risk level and augmented to take into account that WPV2 is an eradicated pathogen, and all PV2 are currently in the process of containment, destruction, or transfer to containment facilities.

The main components or strategies used in the response to a breach of containment and prevention of potential establishment of further transmission include risk assessment, isolation of exposed persons and quarantine of their contacts, stool and throat sample analysis to assess poliovirus shedding, infection control and disinfection, targeted vaccination, and intensification of surveillance. As previously stated, in this document, and consistent with IHR 2005, isolation refers to management of exposed / infected persons, while quarantine applies to their contacts.

Critical factors affecting success of the response will be the timeliness of:

- recognition and reporting of the incident (section 5);
- thorough but timely risk assessment of the containment breach (section 8);
- identification of the source or cause, root cause analysis of the breach and its rectification including prevention of recurrence (GAP III);
- identification of all PV-exposed or infected persons and their isolation where indicated (section 9);
- contact tracing and quarantine where indicated (section 9);
- testing⁶ for poliovirus shedding and vaccination of exposed persons and their contacts (section 9).

The GPEI has supported the development of antiviral agents to clear prolonged or chronic poliovirus infection among individuals with primary immunodeficiency disorders, for post-exposure prophylaxis, and potentially for outbreak control. An antiviral agent may also be available in the future for post-exposure prophylaxis for people exposed to poliovirus, under an investigational new drug protocol.

⁶ In vaccinated persons, oral PV excretion is rare, but should be included in testing because it has implications for isolation and quarantine measures used (ie whether droplet precautions are also needed).

7 Ethics considerations

Given the high cost of polio eradication, including considerable human resources and finances, and the personal sacrifices and danger faced by many workers and volunteers in achieving eradication, there is an enormous ethical imperative to maintain poliovirus containment well into the future, and to respond vigorously to any breaches. GAPIII and the CCS are aimed at preventing exposure to polioviruses after eradication, while this guidance is aimed at limiting the consequences of any accidental exposure. Reducing the number of PEF's is a major path to reducing the risk of re-established transmission in the future.

The IHR (2005) in Article 3, Principles, state that “the implementation of these Regulations shall be with full respect for the dignity, human rights and fundamental freedoms of persons.” Restrictions on the freedom of movement, such as isolation and quarantine, can impose a significant burden on individuals (and communities). According to WHO Guidance⁷, in the event of infectious disease outbreaks, these measures can be justified by the ethical value of protecting the community and public health, but should not be implemented without careful attention to the following considerations (which are reflected in tables 1 and 2, in section 9):

- a) justifiable evidence-base for imposing restrictions;
- b) implementation in a manner that imposes the fewest constraints possible to reach the public health goal;
- c) ensuring humane conditions, e.g. access to basic necessities;
- d) addressing financial and social consequences for individuals;
- e) due process protections: complaint and review mechanisms should be in place;
- f) equitable and non-arbitrary application;
- g) communication and transparency: will enhance public trust and compliance.

The identity of the concerned individuals should only be shared on a need-to-know basis, i.e. not released to the public, to avoid stigma and discrimination.

⁷ Guidance for Managing Ethical Issues in Infectious Disease Outbreaks, WHO, 2016.

8 Risk Assessment of the PV Exposure

Recognizing that the risk of transmission and re-established circulation varies significantly according to the context, and that the response needs to be proportionate and tailored according to the risk and potential impact, the following event risk stratification has been made. The stratification that places PV2 exposures at the highest level is based on the following facts:

- WPV2 is the only PV that has been officially eradicated as of February 2019.
- Since OPV2 was withdrawn in 2016, type 2 population intestinal immunity is lower than for PV1 or PV3.
- IPV provides protection against polio disease, but is less effective against intestinal infection, excretion, and therefore transmission
- While WPV1 has been eliminated in most countries and WPV3 in all countries, the availability of bOPV means that population immunity is likely higher for PV1 and PV3 compared to PV2.

Very high risk

- Any containment breach or exposure anywhere involving WPV2 or VDPV2

High risk

- Any exposure involving WPV1 / VDPV1 or WPV3 / VDPV3
- Any exposure involving SL2, in a country or surrounding area (within a radius of 100 km) with inadequate type 2 immunity (<90% IPV coverage according to the respective national schedule⁸) OR has lower access to basic or safely managed sanitation (< 95% of the population as per UNICEF / WHO JMP data⁹)

Low risk

- Any exposure involving SL2 in a country and the surrounding area with adequate type 2 immunity (>90% IPV coverage) AND higher access to basic or safely managed sanitation (converse of high risk as above).
- Any exposure involving WPV2 / VDPV2 PIM

Minimal risk

- Any exposure involving SL1 or SL3 material are considered minimal or no risk situations and are not considered within the scope of this guidance currently, but following OPV cessation in the future, will need to be addressed in a future revision.
- Any exposure involving SL2 PIM

A risk assessment should be conducted by the relevant public health authority and ideally completed within 72 hours of a breach, to identify the following:

- characteristics of the breach (volume, concentration, potential or confirmed exposure of staff, site in facility or whether release outside the facility has occurred);
- use of adequate PPE at time of breach, gowning and de-gowning and decontamination procedures;
- time elapsed since breach (if known);
- the immunization history of the exposed person(s) and their contacts;
- any travel history of the exposed person after the exposure, including within the local community;
- the immunity profile of the local population and areas of suboptimal vaccination coverage;
- any history of PV transmission in the community;
- any subpopulations at high risk, such as unimmunized close contacts or local under-immunized communities; and
- environmental risks that would heighten concern for transmission.

Key facts about poliomyelitis are available in Arabic, Chinese, English, French, Russian and Spanish are available at <http://www.who.int/en/news-room/fact-sheets/detail/ poliomyelitis> .

⁸ at national level as per most recent WUNCEIC estimates

⁹ <https://washdata.org/data>

9 Management of PV-exposed persons and their at-risk contacts, including quarantine and isolation

9.1 Contact Tracing

To limit the potential spread of poliovirus, which is characterized by many asymptomatic infections, contact tracing undertaken by the public health authorities is important to identify potentially infected individuals. There are six categories of people who need to be urgently traced and tested as they may have had contact with the exposed persons (or their stools) and therefore may also be at risk of poliovirus infection or transmitting the virus.

- a) Household contacts: people who lived with the exposed person and shared a toilet during the infectious period. These people, particularly children and the unimmunized, are at greatest risk as they may have had contact with the potentially infected person prior to the detection of virus. Sexual contacts should be considered as at similar risk.
- b) Toilet contacts: other people (non-household contacts) who have shared a toilet with the exposed person during the infectious period, before the toilet was cleaned or disinfected, such as those sharing a toilet at the workplace and visitors to the home. These are especially relevant when there is a delay in isolation of the exposed individual.
- c) Food consumer contacts, where the PV-exposed person prepared food for others to eat.
- d) Facility first aid workers or first responders who rendered assistance to the exposed person, without using personal protective equipment (PPE). If these personnel were also directly exposed, they should be regarded as potentially infected exposed persons, and managed accordingly.
- e) Health care workers who cared for the exposed person during the infectious period.
- f) Sewerage workers, although at very low risk, may also need to be considered in situations of proven infection, where a PV2-infected person was excreting into the general sewerage system prior to isolation, and collection and incineration / inactivation of stools.

For successful prevention of further spread, the tracing of contacts needs to be more rapid than the spread of the virus. Beyond household contacts, who may be at highest risk due to extent and duration of exposure to an infected person, priority should be given to tracing and management of high-risk contacts such as health care workers, food handlers and childcare workers, who have the potential to spread infection to many people. At-risk contacts need to be educated on symptoms of poliovirus infection, personal hygiene, testing and immunization.

Contact tracing does not itself prevent a contact becoming infected with poliovirus, but stool sampling of household and incompletely vaccinated health care worker contacts (as outlined in the tables below) and increased surveillance for clinical symptoms such as acute flaccid paralysis (AFP) will identify spread of the virus and allow prevention of further transmission.

Contact tracing should be carried out with respect of the involved persons' confidentiality, and must be done equitably, avoiding actual or perceived discrimination.

9.2 Management of exposed, and infected persons, and their contacts

Management of exposed persons and their contacts is set out in table 1. If testing detects infection during the management activities in table 1, then table 2 applies, requiring broader use of quarantine of at-risk contacts.

Table 1: Management of PV-exposed persons and their contacts

Activity	Low risk event	Very high risk or high risk event
exposed person		
Isolation - location	At home	If possible and supported by national/local legal framework, hospital isolation room with single bathroom if available should be considered for very high-risk events, particularly if compliance with other control measures is likely to be low. Otherwise home isolation may be used. Public health workers should frequently monitor compliance to ensure strict isolation from household contacts including separate toileting and bathroom, stringent cleaning, disinfection and waste disposal. Stools must be collected and incinerated.
Isolation - duration	Seven days if testing is negative	
Specimen collection and transport to a GPLN accredited laboratory	Daily collection of stool specimens and throat swabs for the presence of poliovirus for at least seven days Baseline blood sample on day of exposure and 15 – 21 days later, as per GPLN guidance (see section 4.1)	
Management of faeces	General sewerage	Very high risk: Collected and incinerated or otherwise inactivated, see also section 10 High risk: Collected and incinerated or otherwise inactivated if the toilet not connected to adequate wastewater management
Health care workers	Hand washing, good hygiene	Appropriate barrier practices: enteric precautions using gown and gloves Respiratory precautions may be required if the person is unvaccinated, until throat specimens are shown to be negative.
Cleaning, disinfection	Household bleach or appropriate equivalent – see section 11	Enhanced cleaning and disinfection – see section 11
Waste disposal, including laboratory samples	Encourage good practices	Should be managed as infectious waste.
Food handling (for other people)	Not permitted	Not permitted
Child care (non-household)	Not permitted	Not permitted
Visitors	Should be limited to close family / friends / care	Should be limited to close family / friends / care providers with proven PV immunity or

	providers with proven PV immunity or vaccination history. Educate visitors regarding handwashing	vaccination history, and compliance monitored. Visitors must take enteric precautions, so gloves and gowns should be provided for home visitors; droplet precautions may also be needed when the exposed person was unvaccinated.
Contacts		
Household contacts	<ul style="list-style-type: none"> • No quarantine • Hygiene advice. • Take two stool samples, 24 to 48 hours apart, starting three days after the contact's <u>first</u> exposure. • Contacts can be considered negative when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus 	<ul style="list-style-type: none"> • Quarantine at home, using separate sanitation. • Take two stool samples, 24 to 48 hours apart, starting three days after the contact's <u>first</u> exposure. • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus.
Toilet contacts Food consumer contacts First aid workers who did not use PPE	<ul style="list-style-type: none"> • No quarantine • Hygiene advice. • Take two stool samples, 24 to 48 hours apart, starting three days after the contact's first exposure. • Contacts can be considered negative when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus 	<ul style="list-style-type: none"> • Quarantine at home. • Take two stool samples, 24 to 48 hours apart, starting three days after the contact's first exposure. • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus.
Vaccination – all at-risk contacts	Take and test a baseline serum sample prior to vaccination with a booster dose of IPV, or if vaccination status is unknown, offer a full course of IPV. Vaccination should not be delayed whilst waiting for a result to the antibody test	
Vaccination – community	Encourage assessment of community immunization coverage and enhancement of routine immunization schedule (e.g. IPV)	

If the testing of the exposed person and contacts results in the detection of proven PV infection, the management activities are set out in the following table 2. In essence, when PV infection is proven, quarantine may need to be employed more broadly.

Table 2: Subsequent management when testing of exposed persons or their contacts demonstrate PV infection (not including SL1 or SL3)

Activity	SL2	WPV, VDPV
Case management		
Isolation - location	Home isolation with frequent monitoring to ensure compliance of the SL2-infected person and household contacts with control measures is high. Public health workers should check compliance with strict isolation from household contacts including separate toileting and bathroom, stringent cleaning, disinfection and waste disposal. Stools should be collected and incinerated or otherwise inactivated.	Hospital isolation room with single bathroom with appropriate waste management
Duration of isolation	Until three negative stool samples collected on three consecutive days	
Health care contacts	Appropriate barrier practices: enteric precautions using gown and gloves. PPE should be properly disposed after use. In cases of proven WPV / VDPV infection who are symptomatic, or whose throat swabs are positive, droplet precautions should also be employed.	
Management of faeces	Collected and incinerated or otherwise inactivated; see also section 10	
Cleaning and disinfection	Enhanced cleaning and disinfection – see section 11	
Waste disposal	Waste should be treated as infectious	
Food handling (for other people)	Not permitted	
Child care (non-household)	Not permitted	
Visitors	Should be limited, and if allowed, restricted to close family / friends / care providers only, and only those with proven PV immunity or vaccination history may visit, but must take enteric precautions. If throat swabs are positive, droplet precautions also required.	
Contacts of the PV infected person		
Household contacts	<ul style="list-style-type: none"> • Quarantine at home. • Take two further stool samples at least three days after the contact's <u>most recent</u> exposure 24 to 48 hours apart. • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus. 	<ul style="list-style-type: none"> • Quarantine at home, if not already implemented. • Take two further stool samples at least three days after the contact's <u>most recent</u> exposure 24 to 48 hours apart. • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus.
Toilet contacts Food consumer contacts	<ul style="list-style-type: none"> • Quarantine at home. • Take two further stool samples at least three days after the contact's 	<ul style="list-style-type: none"> • Quarantine at home, if not already implemented. • Take two further stool samples at least three days after the

	<p><u>most recent</u> exposure 24 to 48 hours apart.</p> <ul style="list-style-type: none"> • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus. 	<p>contact's <u>most recent</u> exposure 24 to 48 hours apart.</p> <ul style="list-style-type: none"> • Contacts can be released from quarantine when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus.
Exposed sewage workers	<ul style="list-style-type: none"> • No quarantine. • Take two stool samples at least three days after the contact's most recent exposure 24 to 48 hours apart. Can be considered negative when two stool samples taken 24 to 48 hours apart are shown to be negative for poliovirus 	
Vaccination – all at-risk contacts	<p>Take and test a baseline serum sample prior to vaccination with a booster dose of IPV, or if vaccination status is unknown, offer a full course of IPV. Vaccination should not be delayed whilst waiting for a result to the antibody test</p>	
Vaccination – community	<p>Encourage community assessment and enhancement of routine immunization schedule (e.g. IPV)</p>	

9.3 Avoiding and managing negative consequences

Every effort should be made to avoid causing financial or material loss to persons subject to quarantine and isolation, and where such loss is unavoidable, compensation should be made available as far as practicable.

Careful explanation of the rationale for isolation / quarantine should be made. Access to counselling should also be made available.

Every effort should be made by public health authorities to prevent stigma that could be associated with quarantine and isolation. This might include avoiding donning PPE in front of the person's housing, avoiding use of vehicles that are likely to draw attention to the fact that residents of the housing are subject to isolation / quarantine, and so on.

10 Sanitation

Faeces should be collected and incinerated or inactivated as per tables 1 and 2.

An alternative in some situations may be the use of separate flush toilets or latrines that are not used by other individuals, provided that standard procedures for wastewater treatment are followed, including at a minimum, on-site septic tank treatment with later controlled removal for further treatment (WHO, 2002¹⁰). Containing the wastewater for a period of time prior to secondary biological treatment will allow for natural die-off of the poliovirus and will significantly reduce the concentration of virus, along with other pathogens, that may be found in the wastewater.

For subsequent waste water management, all direct human contact with excreta should be avoided and

¹⁰ WHO, 2002. Environmental health in emergencies and disasters. World Health Organization, Geneva. http://www.who.int/water_sanitation_health/emergencies/emergencies2002/en/

full PPE should be worn by all workers. Such equipment includes heavy duty rubber gloves, impermeable gown, impermeable apron, closed shoes (e.g., boots), facial protection (mask and goggles or face shield) and ideally a head cover. Workers should be properly trained in putting on, using and removing PPE so that these protective barriers are maintained and not breached.

Regarding 'grey water' or water from washing of PPE, surfaces, and other potentially contaminated objects, it is recommended to use chlorinated water (0.5% hypochlorite) to wash any reusable PPE, as well as surfaces that may have had contact with bodily fluids. This concentration of chlorine is sufficient to inactivate the poliovirus in water that is relatively free of solids (less than 10 mg/L).

11 Cleaning and disinfection at the hospital / home.

Proper cleaning and disinfection of areas contacted by an infected individual is required to prevent onward transmission.¹¹ The aim of cleaning is to remove soiling that may harbor and protect viral particles from disinfection. Effective disinfectants are those which contain free chlorine, such as sodium hypochlorite or bleach, glutaraldehyde solutions, formaldehyde solutions and iodophores. Contact time is also important in inactivating the virus.

Soiled linen should be safely disposed of, and any other laundry should be soaked in chlorine bleach (diluted according to the manufacturer's instructions) for at least 15 minutes.

Some common disinfectants such as 70% ethanol, isopropanol, lysol and quaternary ammonium compounds are not effective against poliovirus. The virus is also resistant to lipid solvents (such as 'Dettol') and is stable in many detergents at room temperature. For thermal inactivation, a temperature of 60°C for one hour, or 70°C for 10 minutes will reduce the infectivity of poliovirus.

12 Enhanced surveillance

Surveillance needs to be intensified in the local area surrounding the facility where the breach occurred, and near the exposed person's residence, work place, or other epidemiologically important location.

- a) Alert diagnostic laboratories in the area to the possibility for poliovirus to be detected, and plan for referral of specimens to facilities with appropriate containment
- b) Alert paediatricians and other clinicians about the need to participate in intensified surveillance for cases of acute flaccid paralysis (AFP) or clinical surveillance for suspect polio. Hospital records may need to be checked for AFP cases if there has been a delay in appropriate management of exposed persons and contacts.
- c) Consider ad hoc limited duration environment surveillance around the exposed person's home and the PEF, in consultation with the WHO Regional Office. Selection of possible sampling points around a PEF should be carried out during the planning of establishment of a PEF.

A Laboratory Surge Plan may need to be activated. The number of specimens to be tested from contacts of the exposed persons can quickly increase. Nucleic acid based tests (reverse transcription polymerase chain reaction, RT-PCR) are more amenable to high throughput testing than virus culture, but these are

¹¹ Survival of poliovirus is favored by lower temperatures and high moisture content. Once excreted, the virus can survive outside the human body for weeks at room temperature. Laboratory studies have shown that poliovirus survival in the environment is enhanced at high relative humidity. Interpolating data from various studies, Dowdle and Birmingham estimated poliovirus infectivity to decrease by '90% every 20 days in winter and 1.5 days in summer, in sewage every 26 days at 23°C, in fresh water every 5.5 days at ambient temperatures, and in seawater every 2.5 days under the same conditions'. Poliovirus survived on cotton fabric with minimal loss for 24-48 hours at ambient temperature and 35% relative humidity, with rapid loss after 48 hours. Poliovirus survived longer on woolen fabrics with recovery after 20 weeks at the same humidity

not yet fully validated and implemented for direct stool testing. The National Polio Laboratory (NPL) should be in the position to provide public health authorities with test results, either at the NPL or by referral to a regional / global reference laboratory, keeping in mind that only designated PEFs can work with PV2 at this time, and this will also apply to PV1 and PV3 in the future. In consultation with key stakeholders, the public health response could be based on the RT-PCR testing of patient specimens with the timing of confirmatory virus culture dependent on the number of cases involved.

Ethical aspects of enhancing surveillance include:

- Protecting the confidentiality of personal information — The unauthorized disclosure of personal information collected during an event (including name, address, diagnosis, family history, etc.) can expose individuals to significant risk. Countries should ensure that adequate protection exists against these risks, including laws that safeguard the confidentiality of information generated through surveillance activities, and that strictly limit the circumstances in which such information may be used or disclosed for purposes different from those for which it was initially collected.
- Assessing the importance of universal participation — Public health surveillance is typically conducted on a mandatory basis, without the possibility of individual refusal. Collecting surveillance information on a mandatory basis is ethically appropriate on the grounds of public interest if an accountable governmental authority has determined that universal participation is necessary to achieve compelling public health objectives. However, it should not be assumed that surveillance activities must always be carried out on a mandatory basis.
- Disclosing information to individuals and communities — Regardless of whether individuals are given the choice to opt out of surveillance activities, the process of surveillance should be conducted on a transparent basis. At a minimum, individuals and communities should be aware of the type of information that will be gathered about them, the purposes for which this information will be used, and any circumstances under which the information collected may be shared with third parties. In addition, information about the outcome of the surveillance activity should be made available as soon as reasonably possible. Careful attention should be given to the manner in which this information is communicated, in order to minimize the risk that subjects of surveillance may face stigmatization or discrimination

13 Education of health care workers

As part of the control strategy, education will be essential. Health care workers need to be reminded of appropriate contact precautions, testing and immunization. Cleaning staff will need to be educated on appropriate cleaning agents and contact times as well as appropriate precautions.

14 Communication Strategy

A breach from a facility handling PV with exposure of persons or populations to an eradicated organism is likely to attract a great deal of media interest. A communication expert from the public health authority should be involved at the earliest stages of the response and spokesperson/s identified.

The communication strategy should ensure that accurate information is provided to the media and the community, as release of inaccurate or premature information may have serious repercussions for the affected individual, their family, health care workers and their community. The identity of the exposed individual should be kept confidential as far as possible. The media may also be important in educating the public on the assessed risk, and the role of sanitation, hand washing and immunization in the response to the incident.

It is important that the media are presented with up-to-date and factual information in order to

minimize speculation and public concern. It is important for key stakeholders to have agreed on a national notification and communication strategy, and for ongoing coordination between parties to ensure consistency in messaging and approach.

Efforts should be made prior to any incident occurring to engage the community in the risks associated with hosting a PEF; this should be proportionate to both the risks and benefits pertaining to the PEF, and should avoid unnecessarily raising alarm.

For information on effective media communications during public health emergencies, see these links:

<http://www.who.int/risk-communication/guidance/download/en/>

http://www.who.int/csr/resources/publications/WHO_CDS_2005_31a/en/

15 Outbreak Management

Where ongoing transmission of WPV / VDPV is occurring, i.e when a breach event becomes an outbreak, an immunization campaign will need to be urgently implemented as per the standard operating procedure for outbreak management (see SOP <http://polioeradication.org/polio-today/polio-now/outbreak-preparedness-response/>).

16 After-action debrief and guidance revision

After each event, rapidly undertake and complete a collaborative after-action review of response measures implemented at each level, and recommend improvements of the guidance and emergency plan. Implementation of the corrective and preventive action plan set up by the facility and local and national public health authorities should be monitored by the relevant authorities. This guidance will be reviewed as required after each event of significance to benefit from lessons learned.