
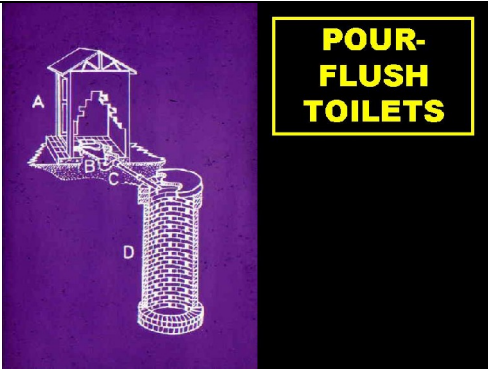


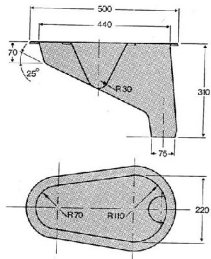
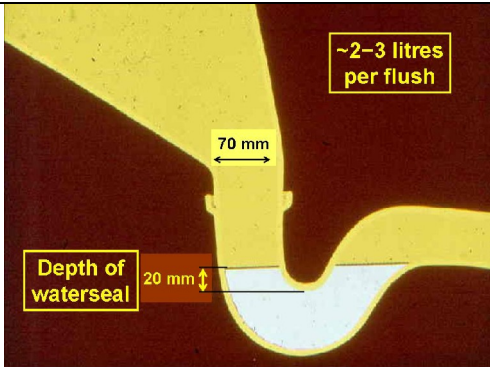
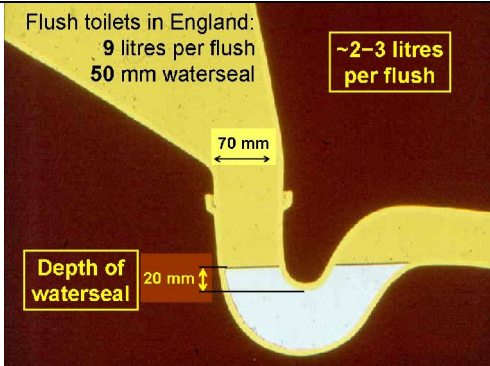


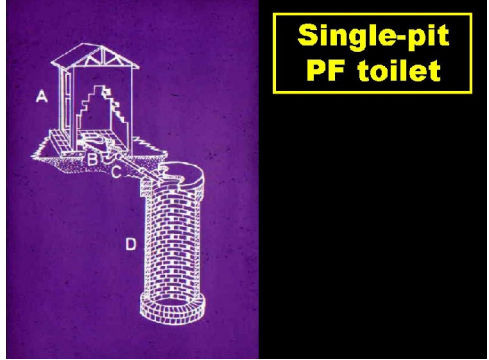
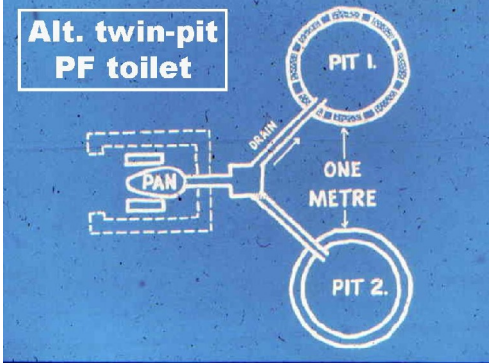
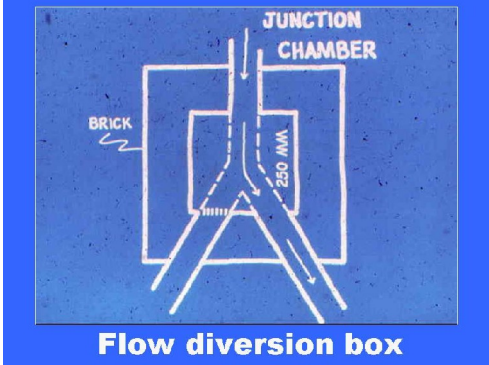
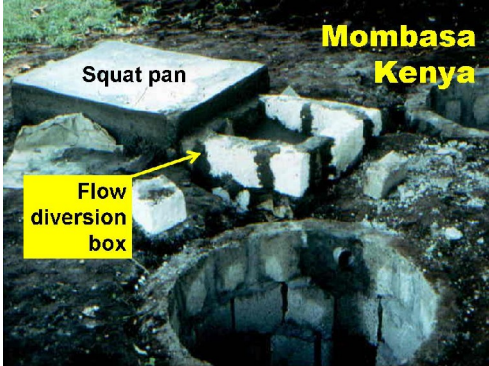









# Pour-flush Toilets





<p>1.</p>	 <p><b>On-site Sanitation III</b> <b>Pour-flush toilets</b></p> <p>Professor Mara</p>	<p>This presentation is on pour-flush toilets, which can be either single-pit units or alternating twin-pit systems.</p>
<p>2.</p>	 <p><b>POUR-FLUSH TOILETS</b></p>	<p>This is a single-pit pour-flush toilet. A is the superstructure; B, the squat-pan and waterseal; C, the connecting pipework; and D, the leach pit.</p>
<p>3.</p>	 <p><b>POUR-FLUSH TOILETS</b></p> <p><b>Especially suitable for 'washers' (but also OK for 'wipers')</b></p>	<p>Pour-flush toilets are especially suitable for those who use water for anal cleansing, but they're also OK for those who don't.</p>
<p>4.</p>		<p>The excreta are manually flushed with about 2–3 litres of water into the leach pit.</p>

<p>5.</p>	 <p><b>POUR-FLUSH TOILETS</b></p> <p><b>Squat pan details (ergonomic design)</b></p>	<p>This slide shows an ergonomic design for the squat-pan developed by the Indian Building Research Establishment in Roorkee.</p>
<p>6.</p>	 <p><b>~2-3 litres per flush</b></p> <p>70 mm</p> <p>Depth of waterseal 20 mm</p>	<p>The key design feature is the 20-mm waterseal depth which enables effective flushing with just 2–3 litres of water.</p>
<p>7.</p>	 <p>Flush toilets in England: 9 litres per flush 50 mm waterseal</p> <p><b>~2-3 litres per flush</b></p> <p>70 mm</p> <p>Depth of waterseal 20 mm</p>	<p>This is in contrast to the situation here in England, where the waterseal depth is 50 mm and 9 litres of water are used per flush.</p>
<p>8.</p>	 <p><b>Low-cost low-flush polypropylene squat pan</b></p> <p>India (<a href="http://www.toiletsforall.org">www.toiletsforall.org</a>)</p> <p><b>Cost: ~Rs70 per pan</b></p>	<p>These polypropylene squat-pan and water-seal units are made by an NGO in India. They're easy to keep clean and they only cost around 70 rupees – that's less than £1.</p>

<p>9.</p>	 <p><b>Colombian 'rural bowl'</b></p>	<p>For sitters this pour-flush bowl, developed over 30 years ago in Colombia, is very suitable and also low-cost.</p>
<p>10.</p>	 <p><b>Single-pit PF toilet</b></p>	<p>Many pour-flush toilets are single-pit systems, but increasingly, and especially in periurban areas,</p>
<p>11.</p>	 <p><b>Alt. twin-pit PF toilet</b></p>	<p>alternating twin-pit systems are used. There are two leach pits, but only one is used at any one time, usually for a period of at least a year, and often for two years. When this pit is full, it's taken out of service and the other one put into service. Just before the second one is full, the first is emptied, and it's safe for this to be done manually as its contents are all at least a year old.</p>
<p>12.</p>	 <p><b>Flow diversion box</b></p>	<p>This is the flow-diversion box between the squat-pan and the two pits. The outlet to the pit not in use is blocked off, usually with a brick wrapped in hessian, so the excreta are directed to the pit in use.</p>

<p><b>13.</b></p>		<p>This is a demonstration pour-flush toilet we built some years ago near Mombasa in Kenya, and you can see the squat-pan, the flow-diversion box and the two pits.</p>
<p><b>14.</b></p>		<p>This is the first slide of a sequence of slides showing the construction of an alternating twin-pit pour-flush toilet in Pakistan. First of all the location of the two pits and the flow-diversion box are marked out on the ground.</p>
<p><b>15.</b></p>		<p>The pits are then excavated and in this case,</p>
<p><b>16.</b></p>		<p>lined with open-joint brickwork. The vertical joints, except for the top few courses, are left unmortared so that the liquids can infiltrate into the surrounding soil.</p>

<p><b>17.</b></p>		<p>The squat-pan is carefully positioned and levelled, and ...</p>
<p><b>18.</b></p>		<p>then fixed in this position by embedding it in mortar.</p>
<p><b>19.</b></p>		<p>Finally cover slabs, usually of reinforced concrete, are placed over the two leach pits and the flow diversion box, and a superstructure built over the squat-pan.</p>
<p><b>20.</b></p>	 <p>Can be on the first floor</p>	<p>Pour-flush toilets can be in-house facilities and they're not restricted to being only on the ground floor.</p>

<p>21.</p>		<p>In high-density periurban areas the leach pits can be placed in the lane adjacent to the house they serve, and ...</p>
<p>22.</p>		<p>where space is really tight, they can be designed like this, although it would be better to extend the pit-dividing wall outwards and downwards to prevent, or at least minimize, pathogens from the pit in use from recontaminating the contents of the pit not in use.</p>
<p>23.</p>		<p>This slide, from Sri Lanka, shows a simple rainwater collection system to permit rainwater, rather than more expensive drinking water, to be used for pour-flushing.</p>
<p>24.</p>		<p>With 'dry' alternating twin-pits, that's to say pits wholly above the groundwater table, it's OK to have them emptied manually as the contents are pretty well composted – they're odourless and look rather like soil, and more importantly, because the contents are at least a year old, all the excreted pathogens, with the exception of a few <i>Ascaris</i> eggs, will be dead.</p>

<p><b>25.</b></p>	<p style="text-align: center;"><b>Groundwater pollution from on-site sanitation systems</b></p> <ul style="list-style-type: none"> <li>➤ <b>groundwater is not sacrosanct!</b></li> <li>➤ often better to have groundwater polluted than the immediate domestic environment</li> <li>➤ on-site water (wells) plus off-site sanitation is often technically infeasible, and much more expensive than off-site water (standpipes) plus on-site sanitation.</li> </ul> <p style="text-align: center;">❖ <b>only protect groundwater if it is absolutely necessary to do so (ie, if used for public supply)</b></p>	<p>Some rather conservative hydrogeologists and environmentalists are often very much over-concerned about groundwater pollution from on-site sanitation systems, especially pour-flush toilets as they produce more and more contaminated wastewater than VIP latrines, for example.</p> <p>My view is that, from the public health perspective of minimizing disease transmission today, it's often better to have the groundwater polluted rather than the ground. Really the groundwater should only be protected when it's absolutely necessary to do so, not just because 'groundwater should never be polluted'; and ...</p>
<p><b>26.</b></p>	<p style="text-align: center;"><b>Algorithm for distance between latrine pits and shallow wells</b></p>	<p>we now know quite a bit about how to minimize groundwater pollution. This algorithm asks a series of questions, the answers to which lead to recommendations for the minimum separation between latrine pits and shallow wells, either 10 or 15 m, although there're also recommendations to seek further advice from an experienced, but also sensible, local hydrogeologist.</p> <p>The key feature which minimizes pathogen travel away from the pit is the depth of the unsaturated zone, that is to say the distance between the pit base and the groundwater table, and this should be at least 2 m.</p>
<p><b>27.</b></p>	<p style="text-align: center;"><b>Sand envelope to minimize groundwater pollution</b></p> <p style="text-align: center;">Sand size: <math>\leq 1 \text{ mm}</math></p>	<p>Even if it's not 2 m, there are things we can do to minimize groundwater pollution. We can, for example, surround the pit by an annulus of sand, as pathogen travel in unsaturated sand is very poor. The annulus should be at least 500 mm thick, and the sand should be small, no greater than 1 mm in size.</p>
<p><b>Note:</b> PF toilet design details are given in <i>The Design of Pour-flush Latrines</i>, which is listed in 'Supporting material'</p> <p style="text-align: center;">© Duncan Mara 2006</p>		