
From: Joos Van Den Noortgate
Sent: Sunday, 5 April 2020 6:26 PM
To: James Baker
Cc: 'Morter, Sarah (NNUHFT)'; 'Stephen S. Peters'; 'Paul Hunter (MED - Staff)'; Peter Maes
Subject: RE: Expertise on Infectious Waste Management in Developing Countries
Attachments: Temporary Volume reducer manufactoring.pdf; Temporary Volume Reducer operation.pdf; INCINERATION Manual 2012 [Compatibility Mode].pdf

Dear James,

As explained before, it is principally the soft waste that MSF incinerates. For this, we have 3 main solutions:

Volume reducers made from a 200 L (55 gallon) metal barrel for acute emergencies and small remote health post.
Some advantages & inconveniences:

+ Rather easy to make with locally available materials and tools;
+ Cheap;
+ Fast to produce;
+ 'Continuous' burning possible;
+ No need for electricity, nor additional fuel (except some dry wood for starting it up);
- Only single combustion (as only 1 combustion chamber), so some thermo-resistant pathogens might escape, and it creates more toxic pollution than a double combustion incinerator;
- Needs to be replaced quite often due to corrosion;
- Not suited for hazardous waste, nor for organic waste (natural decomposition of the latter is preferred anyways where possible);
- For rather small quantities of soft waste;
- Efficacy will depend on the calorific value of the waste and the operator's skills.

The description how to make and operate such a drum volume reducer can be found in the MSF '*Public Health Engineering*' guidelines I sent already before in Technical Brief (T.B.) 6.5 on pages 308 till 310. I also attached even more detailed step-by-step descriptions with pictures how to fabricate and operate such a drum volume reducer, both retrieved from internal MSF manuals related to medical waste management.

'Popular' alternatives to simple drum volume reducers which can be purchased are:

- SmartAsh https://www.elastec.com/products/portable-incinerators/smartash/ This is basically a trolley (on which a 55 gallon barrel has to be placed) with an additional lid containing a fan that should increase its burning capacity. The fan makes the air supply easier, but more air does not always mean higher combustion temperatures. It is promoted as an incinerator that can even destroy expired drugs, but it is more a glorified drum waste reducer as it keeps about the same inconveniences as described above, which on top of those requires electricity and is quite expensive. Continuous operation is impossible as the lid must be removed to add more waste. It still relies mainly on the calorific value of the waste. The biggest advantage in comparison to a simple drum volume reducer is the spark arrestor which makes it safer.
- SICIM, often nicknamed Sputnik due to its shape. It is still a single combustion chamber volume reducer with similar inconveniences as described above, and expensive!

Auto-combustion incinerators made from refractory material for longer term use in health centres and small hospitals.

Some advantages & inconveniences:

+ Relatively easy to construct by skilled staff (if instructions are followed precisely);
+ Relatively cheap, certainly in comparison with dual chamber (semi-industrial) incinerators;
+ Double combustion chamber, so less risk of thermo-resistant pathogens escaping;
+ 'Continuous' incineration possible;
+ No need for electricity, nor additional fuel (except some dry wood for starting it up);
- Retention time too short to reduce sufficiently toxic exhaust gasses generated by certain wastes;
- Not suited for hazardous waste, nor for organic waste (natural decomposition of the latter is preferred anyways where possible);
- For rather small quantities of soft waste;
- Longer to build than a drum volume reducer;
- Efficacy will depend on the calorific value of the waste and the operator's skills.

The general principles of such an incinerator can be found on page 311 of the MSF '*Public Health Engineering*' guidelines.

The typical auto-combustion model that is used by several aid-agencies is the **De Montfort incinerator.** Please find attached the MSF construction and operation manual of this incinerator, which has been pragmatized in collaboration with the original designer Jim Picken.

Dual chamber (semi-industrial) incinerators to be purchased for long-term use in (big) hospitals, often for urban settings and/or when the legislation dictates this kind of equipment. A distinction can be made between:

- **High temperature incinerators (batch loaded)** which have a retention time of the gasses within its second combustion chamber of at least 2 seconds at 1100 °C (can also be used for the elimination of most medical related hazardous wastes, although officially not allowed by the Stockholm Convention);
- **Medium temperature incinerators (batch loaded)** which have a retention time of the gasses within its second combustion chamber of at least 2 seconds at 850 °C (can also be used for the elimination of some medical related hazardous wastes, although officially not allowed by the Stockholm Convention).

Some advantages & inconveniences:

+ Incinerators with burner(s) and fan(s), which makes temperature control easier and more constant;
+ Double combustion chamber, so quasi no risk of thermo-resistant pathogens escaping;
+ Retention time long enough to reduce sufficiently toxic exhaust gasses (depends on the brand & model however);
+ Can be considered as Best Available Techniques in certain contexts for hazardous waste;
+ Depending on the brand & model, can be used for rather big quantities of waste;
- Must be purchased, transported and often imported, making it a long process;
- Expensive, from € 20,000 till 100,000 depending on the brand, model and accessories chosen;
- Requires electricity and quite some fuel, thus potentially (very) high running costs (certainly if hazardous and organic waste are being incinerated);
- Depending on the brand and model quite high-tech, so specialised maintenance and repair staff required;
- Continuous incineration not possible, except if an expensive mechanical loader is added which is only available for some brands and models.

These kinds of incinerators necessitate quite some management despite that often the opposite is believed. They will still require a good segregation of the waste as they will not melt the metallic sharps (e.g. needles either) and the liquids of organic waste will increase the running costs tremendously.

I do not want to make publicity here for one brand or another, but typical makes that are being purchased by aid-agencies are:

- Addfield (https://addfield.com/): they claim their medical models MP are high temperature incinerators;

- Inciner8 (https://www.inciner8.com/): these are medium temperature incinerators.

Of course, there are plenty of other good brands on the commercial market!

To be “complete”:

Co-processing is some form of high or medium temperature incineration with recovery of the calorific value of the waste for industrial processes, like cement factories. But this solution is limited for certain hazardous wastes and not for general medical waste (sharps, softs and organics). The hazardous wastes that cannot be co-processed in a cement factory are listed in the ‘*Dirty and Dangerous*’ document already sent before.

Some countries will demand non-incineration solutions like **shredders linked to autoclaves or microwaves**. Quite high-tech and energy demanding, potentially fragile, leaving rather big volumes of sterilized residues and very expensive, they are often not the most appropriate solution for low-income countries, and certainly not for remote and/or resource limited areas. They will not be able to deal with most medical related hazardous wastes, either.

I hope these descriptions will help you already further.

Best regards,

Joos

Joos Van Den Noortgate
Responsible Innovation & Training
Environmental Health
Médecins Sans Frontières – O.C. Brussels

From: James Baker
Sent: samedi 4 avril 2020 05:46
To: Joos Van Den Noortgate
Cc: 'Morter, Sarah (NNUHFT)'; 'Stephen S. Peters'; 'Paul Hunter (MED - Staff)'; Peter Maes
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

Good Morning Joos,

Thank you for taking the time to prepare these valuable insights for us. The ability to find workable solutions in areas where infrastructure can be limited is especially useful.

Our work continues, as I am sure yours does, to help fight this pandemic.

Do you have someone within MSF who specialises in sourcing and distributing small medical incinerators for field use? We have had some enquiries from our member countries concerning potential suppliers, designs and specifications.

Many thanks

James

From: Joos Van Den Noortgate
Sent: Friday, 3 April 2020 9:35 PM
To: James Baker
Cc: 'Morter, Sarah (NNUHFT)'; 'Stephen S. Peters'; 'Paul Hunter (MED - Staff)'; Peter Maes
Subject: RE: Expertise on Infectious Waste Management in Developing Countries
Importance: High

Dear James,

My sincere apologies for only providing the MSF information on waste management for LMIC now, but I have been overloaded with technical questions regarding Covid-19 which needed urgent attention.

Anyway, MSF has been working for a long time on pragmatic solutions for medical waste management in low- and even middle-income countries. We started from treatment and disposal options that are or can rather easily be made available in low-income countries, and then we worked upstream to define the technical steps and the different waste categories. As such, we don't always follow exactly the waste categories and principles WHO is describing, but we respect as much as contextually possible the different UN conventions: Basel, Stockholm, Minamata. WHO recognizes the MSF medical waste management principles for emergencies and very deprived settings. The attached MSF document *'Dirty and Dangerous'* gives a general overview of our principles. I also add the MSF *'Public Health Engineering in Precarious situations'* guidelines, where chapter 6 gives more information of how the different medical waste facilities can be installed / constructed.

As you refer in your mail that the focus would be on handling domestic sourced medical waste and rural disposal options, I suppose that the available means will be limited. Hence, the MSF principles might suit your purpose. But to be clear, if a national medical waste legislation is existing, it should be respected. However, in case the legislation would be substandard and not at all WHO / UNEP compliant, the MSF approach could be proposed. Several countries have already adopted our simplified methods, and have asked us to participate in the writing of their hazardous waste guidelines.

Very concretely on your demand, a first reflection as it can be context depending:

- domestic sourced medical waste could be brought to the local health facility (similar to bringing expired drugs to the pharmacy in HIC), where it can be eliminated.
- utilizing cement kilns for the disposal of the infectious medical waste is prohibited according to the Stockholm Convention. Technically speaking the temperatures reached in a cement factory can easily deal with infectious waste, but the risk for the factory staff is too high. So the waste should first be rendered non-infectious before it can go towards the cement factory, and then there is still the risk of metallic sharps (e.g. needle stick injuries). This is a list of wastes that are not allowed to be co-processed (in a cement factory):

    - Electrical and electronic waste (e-waste) like bio-medical equipment;
    - Explosives (not applicable to medical aid-agencies) and pressurized containers like aerosols;
    - Corrosive waste, including mineral acids (e.g. hydrochloric acid, sulfuric acid);
    - Asbestos-containing waste;
    - (High-concentration) cyanide waste (depending on national legislations);
    - Infectious medical waste (sharps, softs and organic waste);
    - Chemical and biological weapons (not applicable to medical aid-agencies);
    - Entire batteries: big and small;
    - Waste consisting of, containing or contaminated with mercury: e.g. broken Hg thermometers, low consumption and UV lamps containing Hg;
    - Unsorted municipal garbage or other waste of unknown composition or having a high metal content.

- Radioactive or nuclear waste;

However, there is an abundance of hazardous waste that can be co-processed, like pharmaceutical waste, pesticides and their empty container, certain non-infectious laboratory waste, etc. Of course, the cement factory management has to agree, and most probably official authorizations will be required.

I hope this gives already a first idea. In case your request was related to COVID-19, some additional precautions should be taken. If you need more information, please do not hesitate to contact me. I will try to answer within a reasonable time frame.

Best regards,

Joos

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Responsible Innovation & Training
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From: Peter Maes
Sent: jeudi 26 mars 2020 11:22
To: James Baker; 'Paul Hunter (MED - Staff)'
Cc: 'Morter, Sarah (NNUHFT)'; 'Stephen S. Peters'; Joos Van Den Noortgate
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

Dear Joos,

Can you take the lead in this interaction but great if you can keep me in cc as one is never too old to learn.

Have a nice day,

peter-

From: James Baker
Sent: jeudi 26 mars 2020 11:12
To: Peter Maes; 'Paul Hunter (MED - Staff)'
Cc: 'Morter, Sarah (NNUHFT)'; 'Stephen S. Peters'; Joos Van Den Noortgate
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

Good Morning Paul, Peter,

Thank you for your quick response.

We are developing support and guidance for our Developing Member Countries with particular focus on handling domestic sourced medical waste, rural disposal options and the potential to utilise cement kilns in the disposal of the infectious medical waste.

I will let Steve fill in more of the details but we are hoping that we can draw on your expertise in ensuring the validity of the recommendations etc.

Many thanks

James

From: Peter Maes
Sent: Thursday, 26 March 2020 6:00 PM
To: Paul Hunter (MED - Staff)
Cc: Morter, Sarah (NNUHFT); Stephen S. Peters; James Baker; Joos Van Den Noortgate
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

Dear Paul,

Hope you are well in these uncertain times.

I added in Joos to this conversation who is the MSF go-to person concerning medical waste.

Have a nice day,

Peter

From: Paul Hunter (MED - Staff)
Sent: jeudi 26 mars 2020 09:53
To: Stephen S. Peters; James Baker
Cc: Morter, Sarah (NNUHFT); Peter Maes;
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

By all means give me a call.

The two people on panel who I think had the most expertise in medical waste management in the group were:

1. Sarah Morter the lead infection control nurse at the hospital where I used to work and in my view a very knowledgeable person with considerable experience as a nurse in the UK and in low income countries.
2. Peter Maes, Coordinator Water, Hygiene and Sanitation Unit at MSF and another very knowledgeable person

My expertise tends to be around risk health impact and risk assessments.

Best Wishes

Paul

Paul R Hunter
Professor in Medicine

The Norwich School of Medicine
University of East Anglia

http://www.med.uea.ac.uk

From: Stephen S. Peters
Sent: 26 March 2020 02:41
To: James Baker; Paul Hunter (MED - Staff)
Subject: RE: Expertise on Infectious Waste Management in Developing Countries

Hi Paul

Just following up on James's email. It would be wonderful to speak with you. We are getting a lot of requests from our developing member countries on waste handling and treatment.

Here is a blog I published last week on the infrastructure side going forward, now our work is more focused on the ground ways of dealing with infectious waste in our DMCs and what tools they have to destroy it.

https://blogs.adb.org/blog/proper-disposal-medical-waste-can-help-us-cope-pandemics

Best regards

Steve
Stephen S Peters,
Senior Energy Specialist (Waste to Energy)
Energy SG, SDSC
Asian Development Bank
www.adb.org

From: James Baker
Sent: Thursday, March 26, 2020 10:19 AM
To: Paul Hunter
Cc: Stephen S. Peters
Subject: Expertise on Infectious Waste Management in Developing Countries

Good Morning Paul,

I have found your contact details on *Recommendations for dealing with waste contaminated with Ebola virus: a Hazard Analysis of Critical Control Points approach*

We are developing support recommendations for the developing member country members of the Asian Development Bank.

Do you have the contact details the specialist in infectious waste management who worked on this paper with you?

Many thanks

James Baker

Consultant to ADB