Disaster Waste Management Principles

The following is a summary of the key principles for management disaster waste, as developed in:

Brown, C., 2012. Disaster Waste Management: a systems approach. Thesis in Doctor of Philosophy, Department of Civil and Natural Resources Engineering, University of Canterbury, Christchurch, New Zealand.

Strategic Management

1. A strategic management approach, distinct from peace-time structures is generally required to ensure recovery objectives are met.
2. An entity must be given the responsibility and mandate to lead disaster waste management activities toward community-wide recovery goals.
3. If there is an urgency to clean-up, responsibility for strategic management should be delegated to the recovery authority.
4. It is vital that the strategic management structure has strong links with those with vested interest and long-term responsibility for waste management facilities and operations.
5. If peace-time waste authorities are responsible for strategic management of disaster waste, appropriate authority and mandate must be given to the organisation for the purposes of the recovery.
6. Waste activities should be managed under the recovery organisation where waste management activities have a strong interconnectedness with other recovery activities. This is particularly relevant where there are a high number of displaced persons, high disruption to the road network and high human health impacts.
7. The disaster scale (and resultant economic and social impact extent) will inevitably determine what level of government strategic management should occur.
8. Strategic management organisational structures should be tiered and modular such that they can be adapted to different disaster scales.
9. Strategic management personnel must have the capacity to think strategically and objectively (outside their peace-time roles and avoiding silo mentality), therefore, regional and national authorities may be more appropriate than local authorities.

10. The geographic extent of the waste should generally determine the level of government response (i.e. strategic management should, at a minimum, correspond to the physical extent of damage).
11. The geographic extent of waste will trigger involvement of different organisations, in particular where waste extends into different environments (terrestrial, marine, wetland etc.).
12. Strategic managers must provide operational guidelines to ensure waste is handled appropriately.
13. Strategic management structures must prioritise resources to meet recovery objectives.
14. Strategic managers must anticipate and mitigate potential problems.
15. Strategic management structures must assign responsibility for, and oversee, post-disaster environmental and human health risk management.
16. Strategic managers must ensure appropriate monitoring systems are in place to enable effective strategic management and planning.
17. Strategic waste management structures need to include protocol for cross-organisational coordination and collaboration across both waste and recovery functions.
18. Organisational relationships may need to be streamlined to meet the needs of the recovery.
19. Strategic management structures for waste need to bridge between emergency and recovery structures as far as possible while recognising that each structure needs a different approach.
20. Organisational structures and protocols in plans need to account for a range of potentially untrained persons needing to be involved.
21. Strategic waste managers must become a focal point for all communications.
22. Communications personnel should be embedded within the disaster waste management team.
23. Strategic waste managers should develop a proactive public communications strategy.

Funding mechanisms

Funding source (private or public)

1. Public funding mechanisms generally enable more effective strategic management.
2. Public funding, in general, more readily allows for a macro (community wide) rather than micro (individual property) level approach to demolition and waste management.

3. If private funding approaches are preferred, mechanisms must be in place to ensure there is adequate cover across the community, including for residential, commercial and infrastructure.
4. Where there is a high number of displaced persons and there is a desire to repopulate the affected area, public funding may be needed to ensure work on private property is completed where owners are absent.
5. Where there are significant human health hazards in the waste matrix, a publicly funded approach is preferable.
6. Where there are significant environmental health hazards, a publicly funded approach may be desirable.
7. Communities susceptible to hazards that can cause trans-boundary movement of wastes should consider public funding mechanisms for debris management.
8. Public funding for waste collection will be necessary where there is a high disruption to road networks.

Funding delivery mechanisms (direct facilitation, reimbursement, lump sum)

9. Funding mechanisms that directly facilitate the waste management works are more effective at achieving recovery objectives than lump sum or reimbursement delivery mechanisms.
10. Where there is a significant human health hazard or environmental health standards, direct facilitation of the works is beneficial.
11. Direct facilitation reflects the actual costs post-disaster and therefore offers greater quality control. Reimbursement and lump sum offer less and the least quality control, respectively.
12. Direct facilitation reduces the uncertainty in operating waste handling facilities and consequently reduces the potential for environmental legacy issues.

Funding policies

13. Funding mechanisms need to be scalable / adjustable to match the disaster scale.
14. Disaster funding mechanisms, public or private, must routinely include allowances for demolition and debris management, preferably as an item separate from rebuilding. Estimates for post-disaster demolition and debris management costs need to:
    a. Be updated regularly
    b. Be priced to match the local market
    c. Include a post-disaster premium (due to time and/or resource constraints and recycling market changes)

15. Funding sources that determine funding amounts post-disaster need to establish these as soon after the disaster as possible.
16. Funding mechanism policies need some flexibility to allow for effective and efficient waste management options.
17. Funding policies should not only consider direct costs, but also environmental, social and economic effects (and must avoid perverse outcomes).
18. Funding policies should include provision for data collection.
19. Where possible, policy exclusions which may affect implementation, or have significant environmental and human health effects, should be avoided (e.g. asbestos).
20. If funding scope is limited, efforts need to be made to provide education, assistance and incentives for individuals to appropriately deal with that waste.
21. Where multiple funding sources are relied upon, efforts must be made to ensure there are no funding gaps, or overlaps.
22. Funding mechanisms and operational organisational strategies should be designed together to ensure systems can be effectively implemented and there are no funding gaps.
23. A single funding source for each property / building is preferable to avoid organisational complexities and improve recovery efficiencies.
24. Funding providers need to consider the potential for liability due to adverse effects resulting from the disaster response.
25. Funding mechanisms for large scale disasters needs to include a strategic waste management function.

Operational Management

Operational organisation

1. Operational strategies need to consider how project risks should best be managed including: consequences of poor risk management; ownership of risk; incentives for risky behaviour; and appropriate mechanisms to mitigate risks.
2. If well managed, centralised management offers opportunities to ensure recovery objectives are met by prioritising resources and works.
3. If well managed, centralised management offers opportunities to monitor and control the timeliness of the works.

4. Centralised management reduces the demands on the affected community and is easy (for communities) to understand.
5. Centralised management can disempower the community.
6. Central management potentially improves the quality control of the works.
7. Macro (community level) cost control can be better achieved through centralised recovery works.
8. Centralised works allow for waste management systems to be designed on a macro (community) scale.
9. Risks associated with establishing post-disaster waste handling facilities can be mitigated by linking them with front-end (collection and demolition) centralised waste management processes.
10. Individual / private operational management approaches allow for 'cradle to grave' waste management at a micro (site level) scale.
11. Centralised management methods facilitate information gathering, which enables planning and monitoring.
12. Operational management strategies must include mechanisms for information gathering (to enable strategic planning).
13. Operational management strategies need to, where possible, reduce the number and complexity of organisational interfaces.
14. Funding mechanisms must be designed with the desired operational strategy (or strategies) in mind.
15. If a centrally managed operations programme is desired, public funding mechanisms can significantly reduce administrative demands and can improve operational efficiencies.
16. When central management systems are imposed in a privately funded disaster recovery environment (by an entity other than the funder), consideration into cost recovery mechanisms is important.
17. Public funding for central management overhead costs should be considered.
18. For a large disaster scale, centralised management is likely to be highly beneficial.
19. Where there are significant environmental and human health hazards, a centrally managed clean-up is preferable.
20. A centralised approach may be necessary where there has been a significant trans-boundary movement of waste during the hazard event.

21. A high number of displaced persons may indicate a need for a centrally managed approach.
22. Centralised management will be beneficial where there is high disruption to road network (by controlling and rationalising vehicle movements).

Procurement approach (for centralised operational approaches)

23. Cost reimbursement contracts reduce incentives for contractors to adopt risky behaviour (environmental or human health), particularly in cases where there is a high human and environmental health hazard in the waste.
24. Cost reimbursement contracts may reduce contractor incentives to independently develop new waste management options, including recycling markets.
25. Contracts conditions can be written to mitigate risks associated with cost reimbursement contracts.
26. Waste ownership needs to be appropriately incorporated into contracts. Waste ownership will be different depending on contract type.
27. Transparent post-disaster procurement policies need to be established.
28. Where possible, contracts let during the emergency phase should be time limited to allow for full procurement procedures to be followed for long term operations.
29. Regardless of the procurement strategy (and funding mechanism) contractor cash-flow must be facilitated to ensure recovery works can continue.
30. Cost reimbursement contracts can simplify payment chains as service providers can directly charge the Principal (rather than the subcontractor).
31. The work force is likely to be less skilled and operational strategies which increase control of operations (such as centralised management and cost reimbursement contracts) are beneficial.

Human resourcing

32. Where there are significant human health hazards, public participation should not be called on.
33. When waste is difficult to handle and when specialist waste handling equipment is required public participation cannot be relied upon.
34. Reliance on private property owners to manage waste should be avoided when there are a high number of displaced persons or where it is anticipated that there is not a strong desire to participate.

Post-disaster reuse and recycling

Recycling feasibility

1. As the volume of waste increases, the need to recycle will generally increase.
2. As the volume of waste increases, the economic viability of recycling will likely decrease.
3. As the volume of waste increases, resource shortages (primarily labour) are likely to limit recycling capacities.
4. As the geographical extent of damage increases, the feasibility of recycling likely decreases.
5. Geographical isolation will decrease likelihood of post-disaster recycling being feasible.
6. As the human health hazard increases, the feasibility of recycling decreases.
7. The more mixed the waste is (the more difficult it is to handle), the less feasible recycling is.
8. Recycling, as in peace-time, is dependent on the availability and relative costs of alternative waste management options.
9. Funding mechanism policies need to consider indirect costs (as environmentally beneficial options such as recycling are not always the least expensive option).
10. Public perception towards recycling should be assessed and considered during the decision-making process.

Recycling mode: on or offsite

11. Offsite separation reduces the time required onsite to demolish structures.
12. Offsite separation increases the direct costs but likely reduces the indirect costs.
13. Offsite separation costs can be comparable to onsite separation costs where the recovery facility (facilities) is close to the affected area and economies of scale can be realised.
14. Offsite separation is dependent on access to a suitable waste handling facility, relatively close to the affected area.
15. Site separation is more feasible when there are more demolition resources available.
16. Offsite separation may create resource bottlenecks due to the fast demolition, such as: contractor availability, truck availability and waste handling facility capacity.
17. Generally, the more mixed the waste (difficulty in handling), the less likely site separation is feasible.
18. Offsite separation is appropriate where (physical) human health hazards exist.
19. Human and environmental health hazards can be better managed by off-site waste separation.

20. The ability to rely on public participation for site separation (on residential properties), decreases as the number of displaced persons increases.
21. The ability for contractors to site separate waste (on residential properties) increases as the number of displaced persons increases.
22. Separation offsite will allow for greater consolidation of truck movements if there is significant disruption to the road network.

Recycling policies

23. Environmental risks around both onsite and offsite separation need to be considered.
24. Strategic management strategies need to include recycling policies and corresponding institutional support systems.
25. Recycling operations (particularly in terms of timeliness) are better effected under a centrally managed approach.
26. Contract types and terms need to include for recycling.

Environmental and human health risk management

1. Environmental and human health risk decisions need to be made (1) in the context of the wider community recovery and (2) as transparently as possible.
2. Risk managers must maintain oversight of operations to ensure emergent risks are identified and managed effectively. Centralisation of operational activities may reduce likelihood of emergent risks.
3. In the absence of data and a full understanding of the risk, accept a higher level of uncertainty and mitigate against the potential effects as far as possible.
4. When considering permitting exemptions in a post-disaster situation, cost implications and opportunities for misuse need to be considered.
5. Basic notification or reporting should be required for any risky activity to assist authorities in planning and monitoring.
6. An expedited assessment approach is more suitable where risks vary significantly between sites.
7. Central management can reduce the demands on resource constrained regulatory authorities.
8. It is preferable to maintain a skilled workforce for high risk work, particularly if a reduction in peace-time management procedures has been made.

9. Involve community in risk management decisions as far as practical and in particular for activities that will be operational medium to long term.
10. To improve public perception and trust in a risk management approach, consistent standards across the recovery effort are important.
11. Short and long term risk ownership should rest with the same entity, where possible.

Legislation and regulation

Strategic management

1. Overall authority and clear responsibility for management of disaster waste should be incorporated into legal frameworks for recovery.
2. Strategic managers should aim to anticipate necessary legislative changes to: minimise the number of legislative changes and avoid unnecessary legislative changes.
3. Strategic management authorities should have legislated mandate to enable decision-making.
4. If regional or national strategic waste planning is desired, approaches adopted must account for local legislation.
5. Consultation requirements may need to be adapted to the disaster situation, to facilitate timely decision-making.
6. Where possible, regulations should ensure that basic data are collected to aid risk monitoring and strategic planning.

Funding mechanisms

7. Where funding mechanisms are private, legislative powers will be required to ensure funds can be directed strategically toward the recovery objectives.
8. Where central management is desired in a privately funded environment, legislative provisions need to include for cost recovery.
9. Review the impact of any proposed legislative changes on funding eligibility.

Operational management

10. If a waste classification system exists, a disaster waste category is necessary which reflects the nature of the waste and ownership of the waste.
11. Classifying the mixed disaster waste as a single waste product may simplify regulatory or legal requirements.
12. Legislative provisions are needed to allow private property entry in a disaster recovery situation where the threat is not just immediate but may affect the community recovery.

13. Laws need to clearly assign waste ownership and liability for loss of valuables.
14. Demolition and debris management contracts need to include waste ownership clauses. Waste must be delineated into personal property and building materials.
15. Waste ownership laws need to be considered where there is movement of waste during the hazard event (particularly across jurisdictional boundaries).
16. Legislative structures need to allow for the desired operational systems to be implemented.
17. Flexibility around notification periods are useful to allow for necessary programme flexibility. Short notification periods are desirable.
18. Legislation or regulations may need to be altered to increase the available labour resources.
19. Liability implications of volunteer or community participation need to be considered.
20. Legislative provisions need to consider procurement requirements for contracts which commence in the emergency period and endure through the recovery phase.
21. Procurement regulations during the recovery phase need to account for the uncertainty likely in the recovery works.
22. Peace-time recycling mandates should have disaster clauses.
23. Legislative allowances may be necessary to facilitate higher volumes of truck movements (truck weight, operation hours, location etc.) and increase the available truck fleet.

Environmental and human health risk management

24. Emergency legislation should allow for waste facilities to action immediate repair following a disaster.
25. Legislative provisions to expedite hazardous waste handling procedures may be necessary.
26. Legislative authority to prevent contractors (and public) engaging in risky behaviour (such as entering unsafe buildings) may be necessary.
27. Environmental legislative flexibility is required to enable existing and new facilities to cope with the disaster waste.
28. Regulations should be prepared for all possible disaster waste management options.
29. Liability for adverse effects from relaxation of environmental and public health standards needs to be addressed.
30. Emergency laws are not always applicable to recovery. Recovery specific legislation is recommended for large scale events.

31. A clear distinction between emergency and recovery activities needs to be made and allowance needs to be made for activities which transition between the two phases (and legislative frameworks).
32. Legislative authority needs to reside with recovery authorities in collaboration with other relevant authorities.
33. Recovery legislation and regulation changes need to be clearly delineated from peace-time laws.
34. Clear disaster waste management decision-making processes need to be officially established, such as establishment of minimum acceptable standards, or transparent risk / decision assessment processes.
35. Where possible, a legislative framework for recovery should be prepared pre-disaster.
36. Recovery legislative provision must include appropriate delegation authority to empower operational personnel to make operational decisions.
37. Liability protection within recovery legislation may empower decision-makers to make timely decisions.
38. If alteration of peace-time standards is practiced, liability implications should be considered.
39. The impact on liability needs to be considered for legislative or regulatory changes to existing facilities with existing approvals and licences.
40. The number of changes to legislation or regulation should be minimised and a realistic duration should be assigned.
41. Consider disaster waste management requirements when developing peace-time waste strategies and regulations.
42. When preparing recovery legislation legal implications on peace-time legislation and regulation needs to be considered.