CLEAN-UP AFTER VOLCANIC ERUPTIONS: CONSIDERATIONS FOR ST VINCENT

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IMPACTS TO SOCIETY WITHOUT CLEAN-UP

- Perceived and real **public health hazards**
  - Respiratory, eye, skin irritations
  - Axiety, frustration, depression

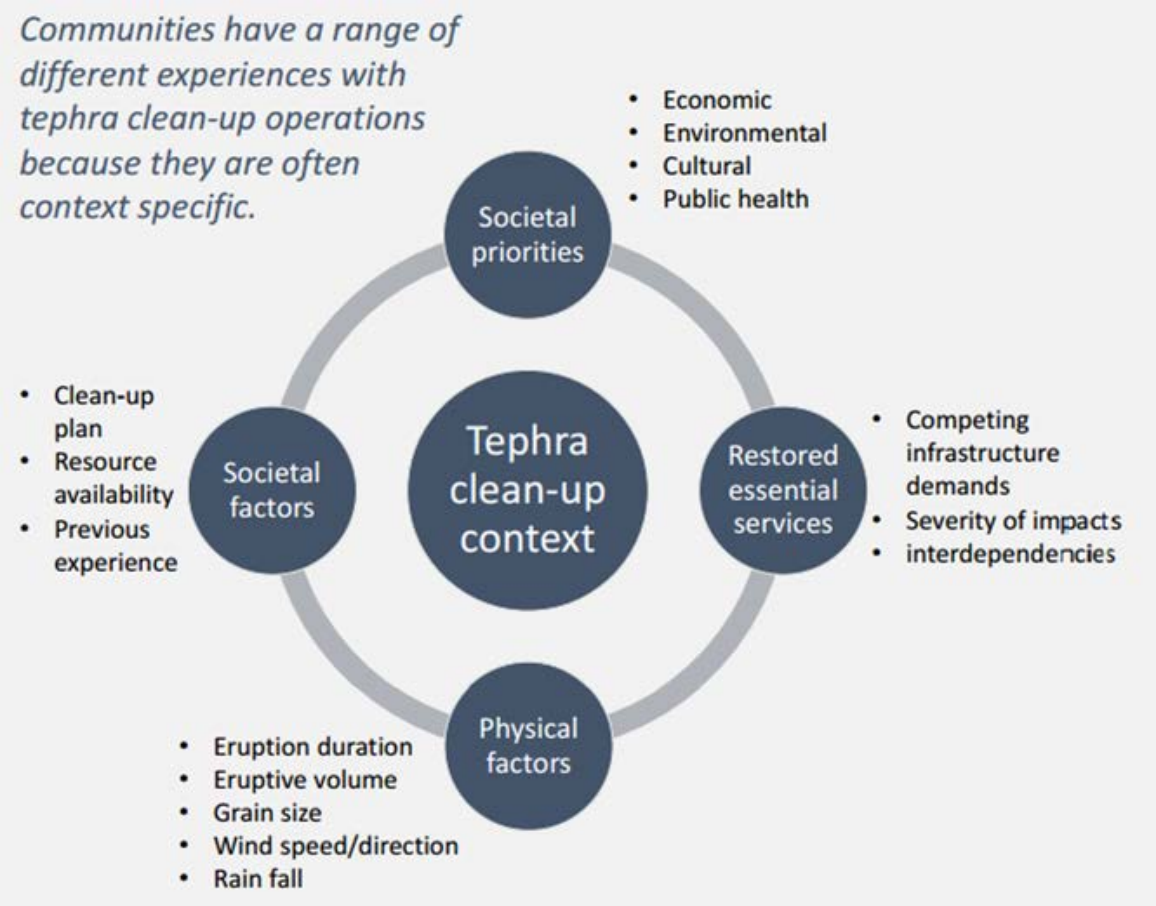
- **Damage** and **contamination** of buildings
  - Roof and structural building component failure
  - Roof corrosion
  - Heating ventilation and air-condition system shutdown
  - Contamination of building interiors - damage to building contents

- Impacts to **infrastructure** systems
  - Road traction reduction / reduced visibility on roads
  - Airport disruption
  - Blocked storm water drains
  - Abrasion / wear and tear on pipes and components
  - Clogged filters on vehicles
  - Power outages

- Each of these impacts **exacerbate impacts** to social and economic activities.

CLEAN-UP: THE ISSUES

- **Huge volumes** of material
  - Resource intensive
  - Costly
  - Time consuming
- Where to **dispose** of ash?
- When to **begin** cleaning up?
- **Prioritisation** of clean-up areas



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SCOPING AND PLANNING

- **Key considerations**
  - **Health and safety** of clean-up workers
    - Potential hazards from the volcano
    - Hazardous waste
    - Necessary PPE
    - Health and safety advice dissemination
    - Cordon management
    - Traffic management within clean-up areas
  - **When** should clean-up commence?
  - **Legal/statutory** requirements
  - **Stakeholder** identification
  - **Public communication**
  - **Funding mechanisms**
  - **Resource requirements** (labour, heavy machinery, trucks, PPE)
  - **Prioritisation** of clean-up areas (e.g. vital roads)?
  - Identifying temporary and permanent **disposal sites**
  - **Management/coordination** of workforce (including volunteer groups)
  - **Triggers** for clean-up crew **mobilisation** if activity continues for long period of time?

ASH CLEAN-UP PROCESS

Ashfall on urban area

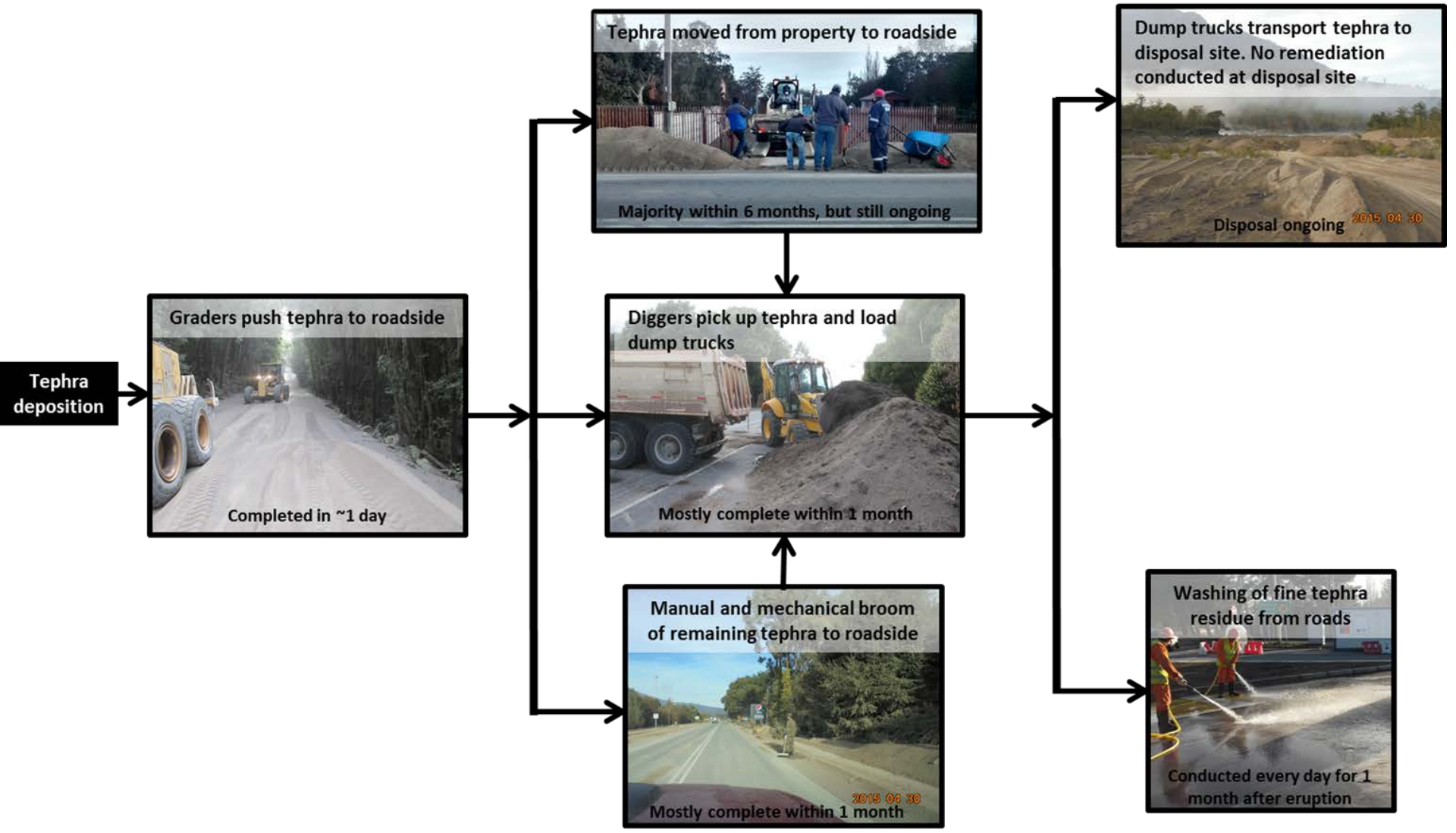
Initial scoping by field managers

Road cleaning / washing

Property clean -up

Bulk removal from roads

Disposal /



Clean-up process for Ensenada, Chile (Calbuco 2015 eruption)

Photos: Victor Gonzalez, Jose Villafana, Javier Soto

SCALING CLEAN-UP RESPONSE

- The management requirements may differ between communities as a function of the **severity of ashfall**.
- At **very low accumulations** (e.g. < 1mm) coordinated clean-up may not be necessary, other than removal/cleaning of roads.
- At 1-5 mm accumulations, clean-up will be more efficient if it is **coordinated**. It is possible that private property owners will require **assistance to remove deposits** from their properties.
- Over 5 mm there will be **considerable demand for machinery such as street sweepers, trucks, graders, and diggers**. Private property owners likely require assistance for removal.

MINOR CLEAN-UP AREAS

- Areas affected by relatively low deposition of tephra (1-10 mm)
- Roads require cleaning using street sweepers and washing of the roads using sprinkler trucks
- Care will be required to minimise tephra ingress into any stormwater systems
- Advice may need to be disseminated to the public regarding appropriate disposal of tephra

MODERATE CLEAN-UP AREAS

- Coordinated clean-up of both the street areas and private properties in these areas will be necessary for an efficient clean-up response.
- Heavy earth-moving machinery necessary to grade tephra to roadside.
- Careful organisation and management of volunteer groups
- Minor - moderate building damage possible
- Potential for contamination at industrial sites (e.g., tephra loading damage to industrial storage tank roofs

MAJOR CLEAN-UP AREAS

- Considerable mixing of waste occurs
- May require access restrictions in places for health and safety, and law and order
- Require demolition activities and associated specialised personnel and equipment
- Specialised cleaning required
- Human remains may be present
- Conceivable that some areas may not be fully restored ($$$, landuse change, or life safety risks)

ASH SUPPRESSION DURING CLEAN-UP

- Light sprinkling of water can reduce remobilisation. But, too much water will cause the ash to become cement-like and stick to surfaces, which is difficult to remove.
- Significant water demand can occur during clean-up operations, which have caused water shortages.

DISPOSAL SITES

- Disposal is a **major issue** associated with ash clean-up due to **large volumes** of material requiring management
- A wide variety of dump sites have been used internationally such as:
  - Old quarries
  - Valleys
  - Fields
  - Water bodies such as lakes
- Existing waste management sites should be avoided for ash disposal **if possible**.
  - Reduces design life of the site

DISPOSAL SITE IDENTIFICATION CONSIDERATIONS

- Operational considerations
  - Size of the site / **how much** ash can be placed on the site?
  - **Access** for heavy machinery (e.g. trucks and diggers)
  - Distance from affected area – **cost** of transportation

- **Long-term** management requirements
  - Slope and land stability issues
  - Potential for erosion
  - Land ownership
  - Potential for negative effects on nearby water supply catchments or groundwater
  - Impacts on sites of cultural / national significance
  - Avoid flood prone areas where possible.

STABILISATION AND REMEDIATION AT DUMP SITES

- **Purpose**: prevent **remobilisation** of the ash over the long term. If no stabilisation is undertaken, ash dump sites can pose an **additional hazard** to nearby communities

- The **most common** form of stabilisation involves **compaction** and then **capping** deposits with **soil and/or planting vegetation**, which helps **bind** ash together.

- Methods of stabilisation should consider necessary environmental standards.

POTENTIAL USES OF ASH

- Ash **can and has** been used for a variety of purposes (e.g. cement production and agricultural products), but consideration of the **logistical** and **technical** requirements is necessary.
- It is **rare** for ash from clean-up activities to be used at such a scale to **substantially reduce** the quantity required for **disposal**.
- **Feasibility** studies will be necessary to identify if the ash is of any potential use.
- Potential considerations:
  - Is there a **viable market** for the product(s)?
  - Does the ash have the necessary **physical characteristics** for the product?
  - What are the **costs and technical requirements** to make the ash a **viable product**?
  - **Decontamination / waste separation** requirements? Particularly important for **highly mixed waste streams** (e.g. areas with ash and considerable building damage)
  - Temporary **storage** requirements?

SUMMARY

- **Appropriate waste management processes** are required for emergency response and recovery after volcanic eruptions.
- **Scale of clean-up** response will **differ** between communities depending on the **severity of effects** from eruption.
- Clean-up is **resource intensive and time consuming**. Planning **critical** to ensure prioritisation of clean-up resources and coordination is effective.
- **Ash suppression/stabilisation** may be necessary to prevent remobilisation.
- Communication to those conducting clean-up on the necessary processes, health and safety requirements necessary.
- **Disposal site selection** should consider both **immediate needs** & **potential long-term impacts**.
- Ash **can** be reused, but **rarely in quantities** sufficient to **significantly** offset the amount that requires disposal.