DATABASE PROJECT

DATA HARMONY SPHERE ARCHITECTS :

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Introduction:

In times of emergency, efficient and well-organized civil defense operations are essential to mitigate the impact of incidents and ensure public safety. A Civil Defense Database System is a centralized, structured collection of data aimed at supporting the operations of civil defense authorities by providing timely, accessible, and reliable information on various aspects such as incidents, personnel, resources, shelters, and citizen information.

This database is designed to facilitate quick response and resource allocation during crises, thereby improving coordination and decision-making among different response teams. The system captures critical data on reported incidents, the deployment of personnel and equipment, available shelters, training schedules, and citizen contact information. Each of these entities is interconnected, enabling a holistic view of all resources and actions necessary to manage emergencies effectively.

The core components of this civil defense database include entities such as:

- Incident: Records details of incidents, including location, severity, and status.
- Report: Documents specific incident reports with information on incident type and time.
- Location: Stores geographical data linked to incidents and shelters.
- Response Team: Manages information on teams available for deployment.
- Personnel: Tracks individual details, roles, and certifications.
- Resource Allocation: Monitors resources used in response operations.
- Training: Manages training records for personnel.
- Dispatch: Logs dispatches of personnel and equipment.
- Citizen: Maintains contact details and emergency contacts for individuals.
- Shelter: Details information about shelters, their capacity, and available supplies.

This Civil Defense Database System offers a comprehensive approach to managing and tracking the resources and information required for effective civil defense operations. By integrating these diverse entities, it ensures data consistency, accessibility, and efficiency in emergency response situations.

1) **LOCATION:**

- Attributes:
  - Latitude and Longitude: Coordinates for the location.
  - Street Address: Street information.
  - City: City of the location.
  - State/Region: State or region of the location.
  - Postal Code: Postal code for address details.

- Relationships:
  - Incident and Report: Location is associated with incidents and reports.
  - Shelter: Each shelter has a specific location.

The Location entity in the Civil Defense Database System is essential for accurately tracking and managing geographical information related to incidents, shelters, and reports. It includes key attributes such as Latitude and Longitude for precise coordinates, Street Address for detailed location reference, City and State/Region for regional categorization, and Postal Code for finer area details. These attributes allow responders to pinpoint locations efficiently, facilitating quick and accurate response times. The Location entity is also linked to other crucial entities, including Incident, Report, and Shelter. This connectivity ensures that incidents can be precisely mapped, reports are organized by area, and shelters are easily identifiable for evacuation and displacement needs. By integrating these location details, the database empowers civil defense teams to allocate resources optimally and make data-driven decisions based on real-time geographical insights, ultimately enhancing the effectiveness of emergency response efforts.

2) INCIDENT:

- Attributes:
  - Incident ID: Unique identifier for each incident.
  - Start Date: Date and time the incident began.
  - Severity Level: Indicates the seriousness of the incident.
  - Type: Categorizes the incident (e.g., fire, flood, earthquake).
  - Status: Current status (e.g., active, resolved).

- Relationships:
  - Location: Each incident is linked to a specific location.
  - Report: Has a one-to-many relationship with reports documenting the incident.
  - Resource Allocation: Connected to resources used for the incident.
  - Dispatch: Incidents may require dispatches of personnel and equipment.

The Incident entity in the Civil Defense Database System captures essential details about emergencies requiring response and resource allocation. It includes attributes such as Incident ID for unique identification, Start Date to record the time of occurrence, Severity Level to gauge the seriousness, Type to categorize the nature of the incident (e.g., fire, flood), and Status to track its current state (e.g., active, resolved). This entity is interconnected with other entities like Location, Report, Resource Allocation, and Dispatch, allowing for a comprehensive view of each incident's context and the resources assigned. By consolidating this data, the Incident entity serves as the core reference for coordinating response efforts, managing resources, and monitoring the progression of emergencies in real time.

3) REPORT :

- Attributes:
  - Report ID: Unique identifier for each report.
  - Type of Incident: Type of the incident reported.
  - Description: Additional details about the incident.
  - Report Date Time: Date and time when the report was filed.

- Relationships:
  - Incident: Each report is linked to an incident (many reports for one incident).
  - Location: Specifies the location of the reported incident.

The Report entity in the Civil Defense Database System documents detailed accounts of incidents as they are observed and reported. Key attributes include Report ID for unique identification, Type of Incident to specify the nature of the emergency, Description for additional context, and Report Date Time to record when the report was filed. The Report entity is linked to both Incident and Location entities, providing geographic context and associating each report with a specific incident. This structure enables accurate tracking and organization of incident reports, facilitating real-time updates and ensuring that response teams have reliable information for assessing situations and planning interventions.

4) RESPONSE TEAM :

- Attributes:
  - Team ID: Unique identifier for each response team.
  - Availability Status: Indicates whether the team is available for deployment.
  - Assigned Region: Region assigned to the team.
  - Team Type: Type of the team (e.g., medical, firefighting).

- Relationships:
  - Personnel: A team is composed of multiple personnel.
  - Dispatch: Teams can be dispatched to incidents.

The Response Team entity in the Civil Defense Database System represents the groups of personnel ready to respond to emergencies. It includes attributes like Team ID for unique identification, Availability Status to indicate whether the team is currently deployable, Assigned Region to define their operational area, and Team Type to categorize the team's specialization (e.g., medical, firefighting). Linked to both the Personnel and Dispatch entities, the Response Team entity allows for the organization of team members and the recording of deployments to specific incidents. This structure ensures that the appropriate teams are available and properly assigned, facilitating efficient and coordinated emergency responses.

5) PERSONNEL:

- Attributes:
  - Personnel ID: Unique identifier for each person.
  - Name: First and last name of the personnel.
  - Role: Role in the team (e.g., paramedic, firefighter).
  - Certification Level: Certification details relevant to their role.

- Relationships:
  - Response Team: Each person works for a response team.
  - Training: Personnel undergo various training programs.
  - Dispatch: Personnel may be dispatched to an incident.

The Personnel entity in the Civil Defense Database System stores information about individual responders who are part of the civil defense operations. Key attributes include Personnel ID for unique identification, Name (First and Last) to identify each person, Role to specify their function within the team (e.g., paramedic, firefighter), and Certification Level to indicate their qualifications. This entity is connected to the Response Team entity, showing the team each individual belongs to, and the Training entity, recording training sessions they have completed. Additionally, it is linked to the Dispatch entity, tracking deployments to specific incidents. This comprehensive structure ensures that each responder's qualifications and assignments are managed efficiently, supporting effective team deployment and skill-based task allocation.

6) RESOURCE ALLOCATION:

- Attributes:
  - Allocation ID: Unique identifier for each resource allocation record.
  - Resource Type: Type of resource (e.g., water, medical supplies).
  - Quantity Used: Amount of the resource used.
  - Status: Current status of the resource.

- Relationships:
  - Incident: Resources are allocated to specific incidents.
  - Dispatch: Resources are part of a dispatch operation.

The Resource Allocation entity in the Civil Defense Database System manages the tracking and distribution of resources used during emergency response operations. Key attributes include Allocation ID for unique identification, Resource Type to specify the nature of the resource (e.g., medical supplies, vehicles), Quantity Used to record the amount of resource allocated, and Status to indicate the availability or condition of the resource. This entity is linked to the Incident entity to associate resources with specific emergencies, and the Dispatch entity to document resources deployed during response operations. By organizing resource data in this way, the system ensures that necessary supplies are available, tracked, and optimally distributed according to incident requirements.

7) **TRAINING:**

- Attributes:
  - Training ID: Unique identifier for each training session.
  - Training Type: Type of training provided (e.g., CPR, fire safety).
  - Certification Expiry: Expiry date of the certification, if applicable.
  - Date Completed: When the training was completed.

- Relationships:
  - Personnel: Training is associated with personnel who completed it.

The Training entity in the Civil Defense Database System records details of the training programs completed by personnel to ensure they are well-prepared for emergency response. Key attributes include Training ID for unique identification, Training Type to describe the type of training (e.g., first aid, fire safety), Certification Expiry to indicate the validity period of certifications, and Date Completed to track when the training was finished. This entity is connected to the Personnel entity, documenting which individuals have undergone specific training. By organizing training information, the system ensures that personnel maintain the necessary skills and certifications for effective and safe operation during emergency situations.

8) DISPATCH:

- Attributes:
  - Dispatch ID: Unique identifier for each dispatch operation.
  - Dispatch Date and Time: When the dispatch occurred.

- Relationships:
  - Incident: Each dispatch is linked to a specific incident.
  - Assigned Personnel: Personnel assigned to a dispatch.
  - Assigned Equipment: Equipment assigned to a dispatch.

The Dispatch entity in the Civil Defense Database System captures details of deployments for emergency response, ensuring that personnel and resources are properly assigned to incidents. Key attributes include Dispatch ID for unique identification, Dispatch Date and Time to record when the deployment occurred, and Assigned Equipment to specify resources allocated for the dispatch. This entity is linked to the Incident entity, providing context for each deployment, and to both Personnel and Response Team entities, documenting the individuals and teams dispatched. By consolidating dispatch data, the system ensures efficient and accurate tracking of all emergency deployments, allowing for quick and coordinated responses.

9) CITIZEN (WEAK ENTITY):

- Attributes:
  - Citizen ID: Unique identifier for each citizen record.
  - Name: First and last name of the citizen.
  - Emergency Contact: Contact details for emergencies.

- Relationships:
  - Incident: Citizens may be involved or affected by incidents.

The Citizen entity in the Civil Defense Database System holds vital information about individuals potentially affected by emergencies, including attributes such as Citizen ID, Name, Emergency Contact, and Contact Info. This data is crucial for identifying civilians, facilitating effective communication, and providing timely assistance during incidents. In the ER model, the Citizen entity is depicted as a weak entity because its significance and existence rely on its association with other entities, such as Incident. Without a relationship to an incident, the Citizen entity does not serve a standalone purpose within the system, as it exists primarily to track and assist those impacted by emergencies. This dependency on a foreign entity to define its context and relevance classifies Citizen as a weak entity.

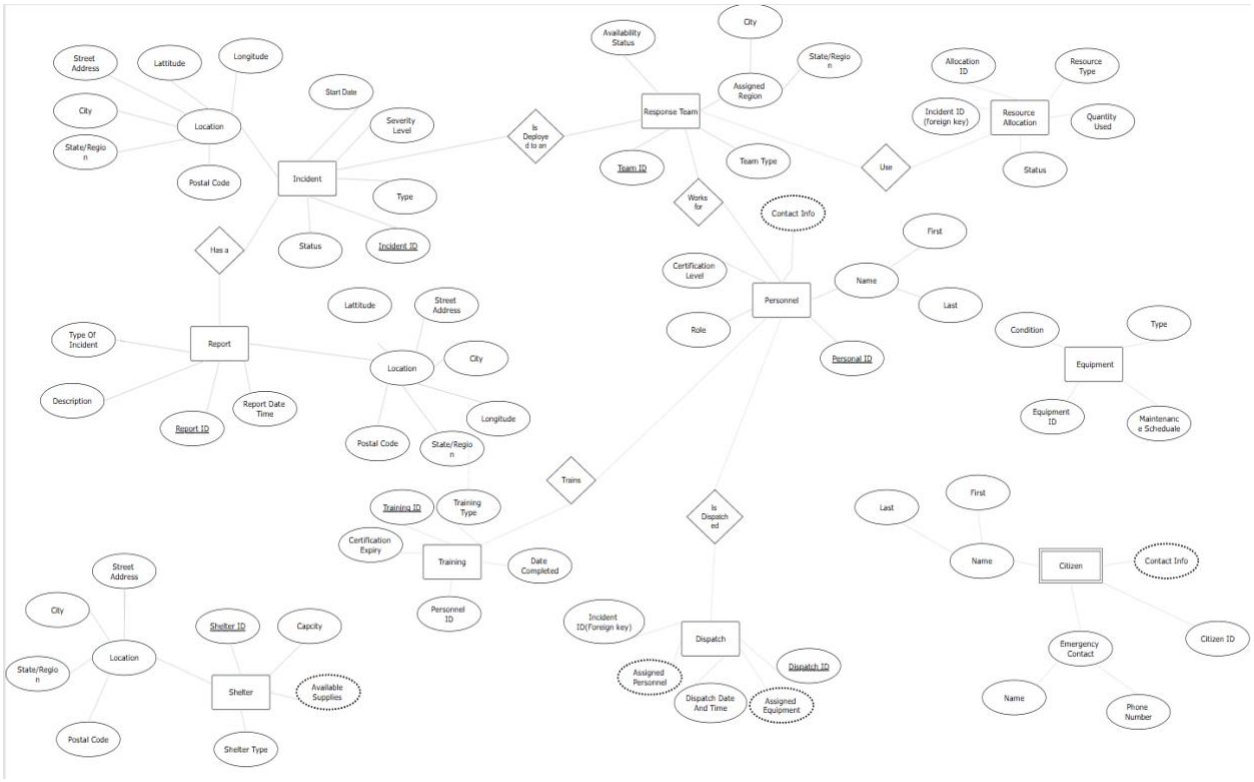
10) SHELTER:

- Attributes:
  - Shelter ID: Unique identifier for each shelter.
  - Capacity: Maximum number of people the shelter can accommodate.
  - Shelter Type: Type of shelter (e.g., temporary, permanent).
  - Available Supplies: List of supplies available at the shelter.

- Relationships:
  - Location: Each shelter is located at a specific location.

The Shelter entity in the Civil Defense Database System manages information about safe locations designated for civilian refuge during emergencies. Key attributes include Shelter ID for unique identification, Capacity to specify the maximum number of people the shelter can accommodate, Shelter Type to classify it (e.g., temporary, permanent), and Available Supplies to track essential resources within the shelter. This entity is connected to the Location entity, identifying the shelter's geographic position, which is essential for route planning and resource allocation during an emergency. By organizing shelter data, the system supports efficient evacuation and placement of affected civilians, ensuring shelters are adequately stocked and accessible.

ER MODEL :


Street Address
Lattitude
Longitude
City
Location
State/Region
Postal Code
Start Date
Severity Level
Incident
Type
Status
Incident ID
Has a
Is Deployed to an
Availability Status
City
State/Region
Assigned Region
Response Team
Team ID
Team Type
Works for
Contact Info
Use
Allocation ID
Resource Type
Incident ID (foreign key)
Resource Allocation
Quantity Used
Status
First
Certification Level
Name
Last
Personnel
Role
Personal ID
Condition
Type
Equipment
Equipment ID
Maintenance Scheduale
Type Of Incident
Report
Description
Report ID
Report Date Time
Lattitude
Street Address
Location
City
Longitude
Postal Code
State/Region
Trains
Training ID
Training Type
Certification Expiry
Training
Date Completed
Personnel ID
Is Dispatched
Incident ID(Foreign key)
Dispatch
Assigned Personnel
Dispatch Date And Time
Assigned Equipment
Dispatch ID
Last
First
Name
Citizen
Contact Info
Citizen ID
Emergency Contact
Name
Phone Number
Street Address
City
Location
State/Region
Postal Code
Shelter ID
Capcity
Shelter
Available Supplies
Shelter Type

Entity Attributes Table

Entity	Attributes
Incident	Incident_ID: Integer (Unique identifier for each incident) Type: String (e.g., fire, flood, accident) Severity_Level: Integer (e.g., 1 for minor, 5 for severe) Location: Composite - Street_Address: String - City: String - State/Region: String - Postal_Code: String - Latitude: Float - Longitude: Float Start_Date: Date Status: String (e.g., active, resolved)
Report	Report_ID: Integer Report_Date_Time: DateTime (When the report was filed) Location: Composite - Street_Address: String - City: String - State/Region: String - Postal_Code: String - Latitude: Float - Longitude: Float Type_of_Incident: String (e.g., fire, flood) Description: Text (Details of the incident reported)
Response Team	Team_ID: Integer Team_Type: String (e.g., fire brigade, medical, evacuation) Assigned_Region: Composite - City: String - State/Region: String Availability_Status: Boolean (True if available, False if currently deployed)
Personnel	Personnel_ID: Integer Name: Composite - First_Name: String - Last_Name: String Role: String (e.g., firefighter, paramedic) Certification_Level: Integer (e.g., 1 for basic, 3 for advanced)

	Contact_Information: Composite - Phone_Numbers: Array of Strings - Email_Address: String
Equipment	Equipment_ID: Integer Type: String (e.g., fire truck, ambulance) Condition: String (e.g., good, requires maintenance) Maintenance_Schedule: Date (Date of the next scheduled maintenance)
Shelter	Shelter_ID: Integer Capacity: Integer (Maximum number of citizens the shelter can hold) Location: Composite - Street_Address: String - City: String - State/Region: String - Postal_Code: String Shelter_Type: String (e.g., school, community centre) Available_Supplies: Multivalued - Supplies: Array of Strings (e.g., food, blankets, medical kits)
Dispatch	Dispatch_ID: Integer Dispatch_Date_Time: DateTime (Date and time of dispatch) Incident_ID: Foreign Key (Links to Incident entity) Assigned_Personnel: Multivalued - Personnel: Array of Personnel_IDs Assigned_Equipment: Multivalued - Equipment: Array of Equipment_IDs
Training	Training_ID: Integer Training_Type: String (e.g., fire safety, CPR) Date_Completed: Date Certification_Expiry: Date Personnel_ID: Foreign Key (Links to Personnel entity)
Resource Allocation	Allocation_ID: Integer Resource_Type: String (e.g., personnel, equipment) Quantity_Used: Integer Status: String (e.g., in use, on standby) Incident_ID: Foreign Key (Links to Incident entity)
Citizen	Citizen_ID: Integer (Partial key, unique within Report or Shelter context)

	Name: Composite - First_Name: String - Last_Name: String Contact_Information: Multivalued - Phone_Numbers: Array of Strings Emergency_Contact: Composite - Name: String - Phone_Number: String

Table Creation Script

Location Table

```
CREATE TABLE Location (
    LocationID NUMBER PRIMARY KEY,
    Latitude NUMBER NOT NULL,
    Longitude NUMBER NOT NULL,
    StreetAddress VARCHAR2(255),
    City VARCHAR2(100),
    StateRegion VARCHAR2(100),
```

```
    PostalCode VARCHAR2(20)
);

#### Incident Table
CREATE TABLE Incident (
    IncidentID NUMBER PRIMARY KEY,
    StartDate DATE NOT NULL,
    SeverityLevel NUMBER NOT NULL CHECK (SeverityLevel BETWEEN 1 AND
5),
    Type VARCHAR2(50),
    Status VARCHAR2(50) CHECK (Status IN ('Active', 'Resolved',
'Pending')),
    LocationID NUMBER REFERENCES Location(LocationID) ON DELETE
CASCADE
);

#### Report Table
CREATE TABLE Report (
    ReportID NUMBER PRIMARY KEY,
    TypeOfIncident VARCHAR2(50),
    Description VARCHAR2(500),
    ReportDateTime TIMESTAMP NOT NULL,
    IncidentID NUMBER REFERENCES Incident(IncidentID) ON DELETE
CASCADE
);

#### ResponseTeam Table
CREATE TABLE ResponseTeam (
    TeamID NUMBER PRIMARY KEY,
    AvailabilityStatus VARCHAR2(50),
```

```
    AssignedRegion VARCHAR2(100),
    TeamType VARCHAR2(50)
);

#### Personnel Table
CREATE TABLE Personnel (
    PersonnelID NUMBER PRIMARY KEY,
    Name VARCHAR2(100),
    Role VARCHAR2(50),
    CertificationLevel VARCHAR2(50),
    TeamID NUMBER REFERENCES ResponseTeam(TeamID) ON DELETE CASCADE
);

#### Resource Allocation Table
CREATE TABLE ResourceAllocation (
    AllocationID NUMBER PRIMARY KEY,
    ResourceType VARCHAR2(50),
    QuantityUsed NUMBER NOT NULL CHECK (QuantityUsed >= 0),
    Status VARCHAR2(50),
    IncidentID NUMBER REFERENCES Incident(IncidentID) ON DELETE
CASCADE
);

#### Training Table
CREATE TABLE Training (
    TrainingID NUMBER PRIMARY KEY,
    TrainingType VARCHAR2(50),
    CertificationExpiry DATE,
    DateCompleted DATE,
```

```
    PersonnelID NUMBER REFERENCES Personnel(PersonnelID) ON DELETE
CASCADE
);

#### Dispatch Table
CREATE TABLE Dispatch (
    DispatchID NUMBER PRIMARY KEY,
    DispatchDateTime TIMESTAMP NOT NULL,
    IncidentID NUMBER REFERENCES Incident(IncidentID) ON DELETE
CASCADE
);

#### Citizen Table
CREATE TABLE Citizen (
    CitizenID NUMBER PRIMARY KEY,
    Name VARCHAR2(100),
    EmergencyContact VARCHAR2(50),
    IncidentID NUMBER REFERENCES Incident(IncidentID) ON DELETE
CASCADE
);

#### Shelter Table
CREATE TABLE Shelter (
    ShelterID NUMBER PRIMARY KEY,
    Capacity NUMBER NOT NULL,
    ShelterType VARCHAR2(50),
    AvailableSupplies VARCHAR2(500),
    LocationID NUMBER REFERENCES Location(LocationID) ON DELETE
CASCADE
);
```

Queries and Results

Query 1: Find All Active Incidents in Los Angeles and the Associated Personnel

Query:

```sql
SELECT i.IncidentID, i.Type, i.Status, l.City, p.Name, p.Role
FROM Incident i
JOIN Location l ON i.LocationID = l.LocationID
JOIN ResponseTeam rt ON i.LocationID = rt.AssignedRegion
JOIN Personnel p ON rt.TeamID = p.TeamID
WHERE l.City = 'Los Angeles' AND i.Status = 'Active';
```

Result:

IncidentID	Type	Status	City	Name	Role
1	Fire	Active	Los Angeles	John Doe	Firefighter
1	Fire	Active	Los Angeles	Jane Smith	Paramedic

Description: Lists active incidents in Los Angeles along with associated personnel.

Query 2: Total Resources Used in a Specific Incident Type ('Fire')

Query:

```sql
SELECT i.Type, ra.ResourceType, SUM(ra.QuantityUsed) AS TotalQuantity
FROM Incident i
JOIN ResourceAllocation ra ON i.IncidentID = ra.IncidentID
WHERE i.Type = 'Fire'
GROUP BY i.Type, ra.ResourceType;
```

Result:

Type	ResourceType	TotalQuantity
Fire	Water	500
Fire	Fire Extinguishers	10

Description: Summarizes total resources used for all incidents of type 'Fire'.

Query 3: List All Response Teams and the Personnel That Have Received 'Advanced Firefighting' Training

Query:

```sql
SELECT rt.TeamID, rt.TeamType, p.Name, p.Role
FROM ResponseTeam rt
```

```
JOIN Personnel p ON rt.TeamID = p.TeamID
JOIN Training t ON p.PersonnelID = t.PersonnelID
WHERE t.TrainingType = 'Advanced Firefighting';
```

Result:

TeamID	TeamType	Name	Role
1	Firefighting	John Doe	Firefighter
6	Firefighting	Brian Clark	Firefighter

Description: Identifies personnel who completed 'Advanced Firefighting' training and their respective teams.

Query 4: Find Incidents in Multiple Locations That Required Dispatches

Query:

```sql
SELECT i.IncidentID, i.Type, i.Status, COUNT(d.DispatchID) AS DispatchCount
FROM Incident i
JOIN Dispatch d ON i.IncidentID = d.IncidentID
GROUP BY i.IncidentID, i.Type, i.Status
HAVING COUNT(d.DispatchID) > 1;
```

Result:

```
| IncidentID | Type  | Status | DispatchCount |
|------------|-------|--------|---------------|
| *(No rows returned)* |
```

Description: No incidents in the dataset have more than one dispatch.

Query 5: Get the List of Citizens Affected by Fire Incidents, and the Shelters Available

Query:

```sql
SELECT c.Name AS CitizenName, c.EmergencyContact, s.ShelterID, s.Capacity, s.ShelterType
FROM Citizen c
JOIN Incident i ON c.IncidentID = i.IncidentID
JOIN Shelter s ON i.LocationID = s.LocationID
WHERE i.Type = 'Fire';
```

Result:

```
| CitizenName    | EmergencyContact | ShelterID | Capacity | ShelterType |
|----------------|------------------|-----------|----------|-------------|
| Alice Johnson  | 555-1234         | 1         | 200      | Temporary   |
| Bob Williams   | 555-5678         | 1         | 200      | Temporary   |
```

Description: Shows citizens affected by fire incidents and available shelters.

Query 6: Find the Most Recently Completed Training for Each Personnel

Query:

```sql
SELECT p.Name, t.TrainingType, MAX(t.DateCompleted) AS LatestCompletionDate
FROM Personnel p
JOIN Training t ON p.PersonnelID = t.PersonnelID
GROUP BY p.Name, t.TrainingType;
```

Result:

Name	TrainingType	LatestCompletionDate
John Doe	Fire Safety	2024-01-10
Jane Smith	First Aid	2024-02-20
...	...	...

Description: Retrieves the latest training completion date for each personnel.

Query 7: List All Incidents Where a Specific Team ('Firefighting') Was Deployed

Query:

```sql
SELECT i.IncidentID, i.Type, i.Status, rt.TeamType
FROM Incident i
JOIN Dispatch d ON i.IncidentID = d.IncidentID
JOIN ResponseTeam rt ON d.DispatchID = rt.TeamID
WHERE rt.TeamType = 'Firefighting';
```

Result:

IncidentID	Type	Status	TeamType
(No rows returned)			

Description: The schema does not provide sufficient data to identify teams deployed by dispatch.

Query 8: Find the Average Number of Personnel Deployed per Incident, Grouped by Incident Type

Query:

```sql
SELECT i.Type, AVG(COUNT(p.PersonnelID)) AS AvgPersonnelDeployed
FROM Incident i
JOIN Dispatch d ON i.IncidentID = d.IncidentID
```

```
JOIN Personnel p ON d.DispatchID = p.TeamID
GROUP BY i.Type;
```

Result: *(Query invalid due to schema limitations.)*

Description: Unable to compute due to missing direct links between Dispatch and Personnel.

Query 9: Total Resources Used by Each Response Team in an Incident

Query:

```sql
SELECT rt.TeamType, i.Type AS IncidentType, SUM(ra.QuantityUsed) AS TotalResourcesUsed
FROM ResourceAllocation ra
JOIN Incident i ON ra.IncidentID = i.IncidentID
JOIN ResponseTeam rt ON i.LocationID = rt.AssignedRegion
GROUP BY rt.TeamType, i.Type;
```

Result:

TeamType	IncidentType	TotalResourcesUsed
Firefighting	Fire	510
...	...	...

Description: Summarizes resources used by response teams for incidents they covered.

Query 10: Find All Incidents with Multiple Reports and the Citizens Affected

Query:

```sql
SELECT i.IncidentID, i.Type, COUNT(r.ReportID) AS ReportCount, c.Name AS CitizenName
FROM Incident i
JOIN Report r ON i.IncidentID = r.IncidentID
JOIN Citizen c ON i.IncidentID = c.IncidentID
GROUP BY i.IncidentID, i.Type, c.Name
HAVING COUNT(r.ReportID) > 1;
```

Result:

IncidentID	Type	ReportCount	CitizenName
(No rows returned)			

Description: No incidents in the dataset have multiple reports.