

CIDM 3350:70/Database System Design: FA 2023: Abraham Sen, Ph.D.

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Project Deliverable 1

1.a Chosen Area:

EHS (Environment, Health, and Safety) in a Warehouse Storage Facility.

- Inaccurate Tracking of Employee Training (Inability to Keep Employees Up to Date)
- Inaccurate Incident Reporting (Inability to Analyze Incident Cause; Potential Legal Consequences/Fines)
- Inaccurate Equipment Inspection Tracking

Project Deliverable 2

1.b Data Management Problems:

Data mismanagement in a warehouse storage facility's EHS department can cause serious problems, including accidents and legal troubles. Mismanagement can make it hard to understand what is happening in the workplace and prevent good safety decisions.

Data is often scattered all over an organization. An example is poor tracking of employee training: the organization is unaware of employees' training being outdated, which can endanger employees. Many companies work out of spreadsheets requiring time-consuming manual data entry. This introduces inaccurate reporting, data entry errors, lack of data standardization across departments, duplicated data, and makes it harder to share data. This can result in failure to report accidents, difficulty in analyzing incidents, and an inability to identify risks.

A centralized database and reporting system would track employees, their departments and supervisors, the training that employees are expected to complete and their completion timestamp and expiration date, equipment inspections, and any incidents along with their date, incident type, severity, description, employee(s) involved, supervisor on duty, equipment involved, root cause, and impact (death/injury, property damage, environmental damage).

1.c Motivation:

The motivation for the EHS database and reporting system is to ensure that employees are up to date on training that equipment is being inspected, and to enable incident root cause analysis. Then the warehouse can reduce risks, ensure employee safety, and avoid lawsuits and/or fines. It will reduce manual data entry, reduce data errors, standardize data, and enable easy sharing of data for analysis.

1.d Potential Benefits:

The potential benefits of the EHS database and reporting system are: that supervisors will have more time to analyze incidents, determine if further training is needed for particular employees or departments, and will be better equipped to make data-driven decisions to prevent future incidents. Efficiency will increase as they can retrieve information faster and reduce 'paperwork hunting'. By having employees up to date on training, they will comply with company policies and improve employee safety (possibly even saving lives).

1.e Potential Users:

The EHS database and reporting system is designed to be used by various professionals, including safety officers, managers, safety training personnel, and supervisors. The database will enhance safety and regulatory compliance, give insights into the impact of safety incidents on the business, and guide efforts to reduce incidents.

2 - Business Rules:

CKM Warehouse Storage Facility

1- Department:

- A department has attributes Department_ID (Identifier) and Department_Name. A department can have multiple employees in it.

2- Employee:

- Every employee must belong to only one department. There are four subtypes for employees: supervisors, forklift operators, equipment inspectors, and inventory clerks. All of the employees share the following attributes. Employee_ID (Identifier), Name, Address, City/State/Zip, and Phone_Number. Only supervisors have training certifications.

3- Incident:

- Incidents may not happen all the time, but when they do, we need to track Incident_Report_ID (Identifier), Employee_Involved_ID, Type, Occurrence_Date, Description, Severity, Supervisor_On_Duty_ID, Root_Cause, Impact, and Equipment_Involved_ID. Multiple employees can be involved in an incident and an employee can be involved in multiple incidents. Up to one supervisor is on duty during an incident. Incidents do not have to have a employee recorded, a un-attended machine can roll out or a equipment could explode. It also doesnt not have to involve an equipment, it could be a dispute.

4-Safety Inspection:

- Attributes include Inspection_ID and also has an Inspector_ID, Equipment_ID, and Inspection_Date. Each inspection is performed by one qualified employee on a specific piece of equipment at a given date and time. Multiple inspections cannot be performed on the same equipment at the same time.

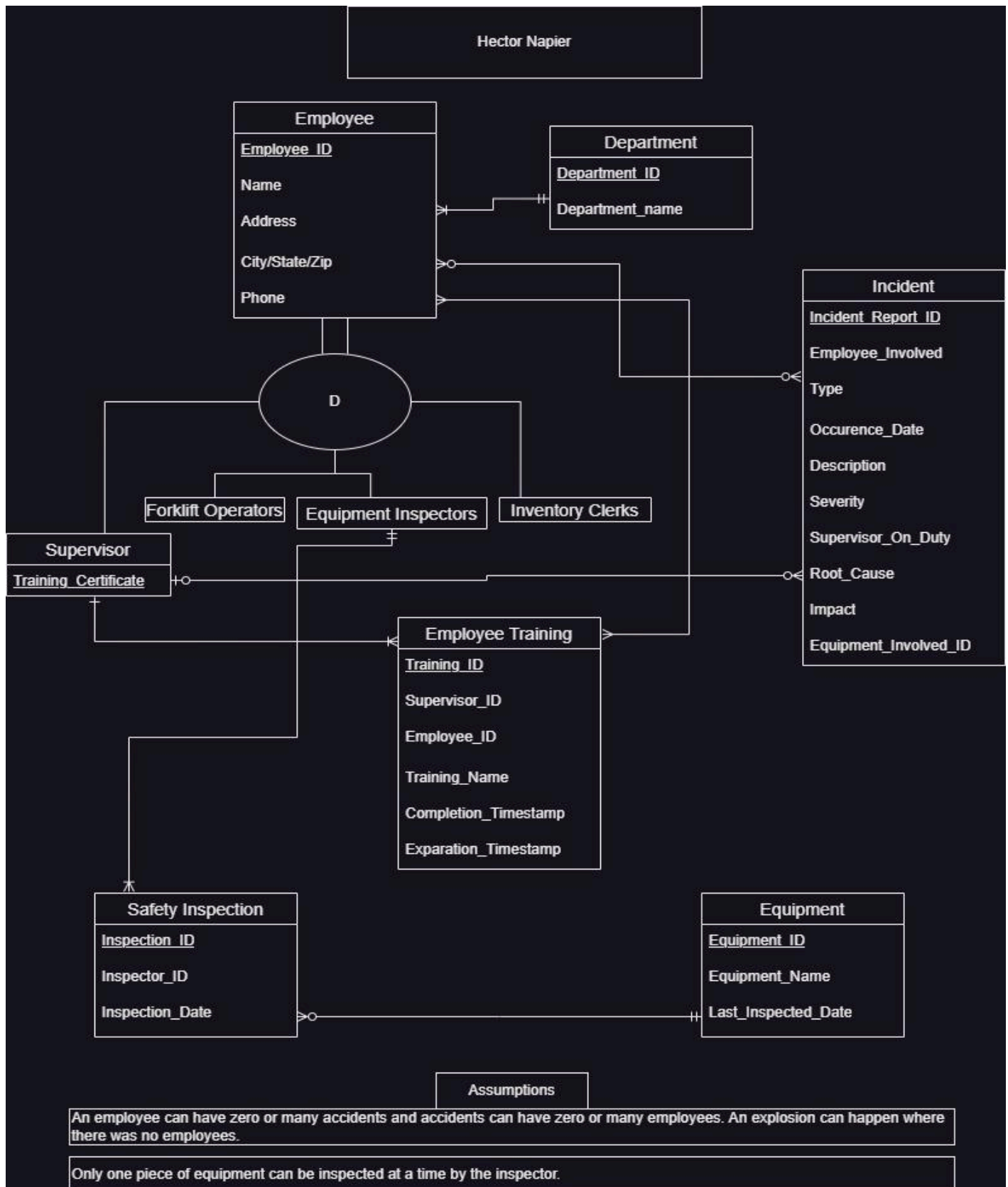
5- Employee Training:

- Employee training has an identifier Training_ID and attributes Supervisor_ID, Employee_ID, Training_Name, Completion_Timestamp, and Expiration_Timestamp. Training is provided by an employee who is in the EHS department. Employees can do multiple training sessions.

6-Equipment:

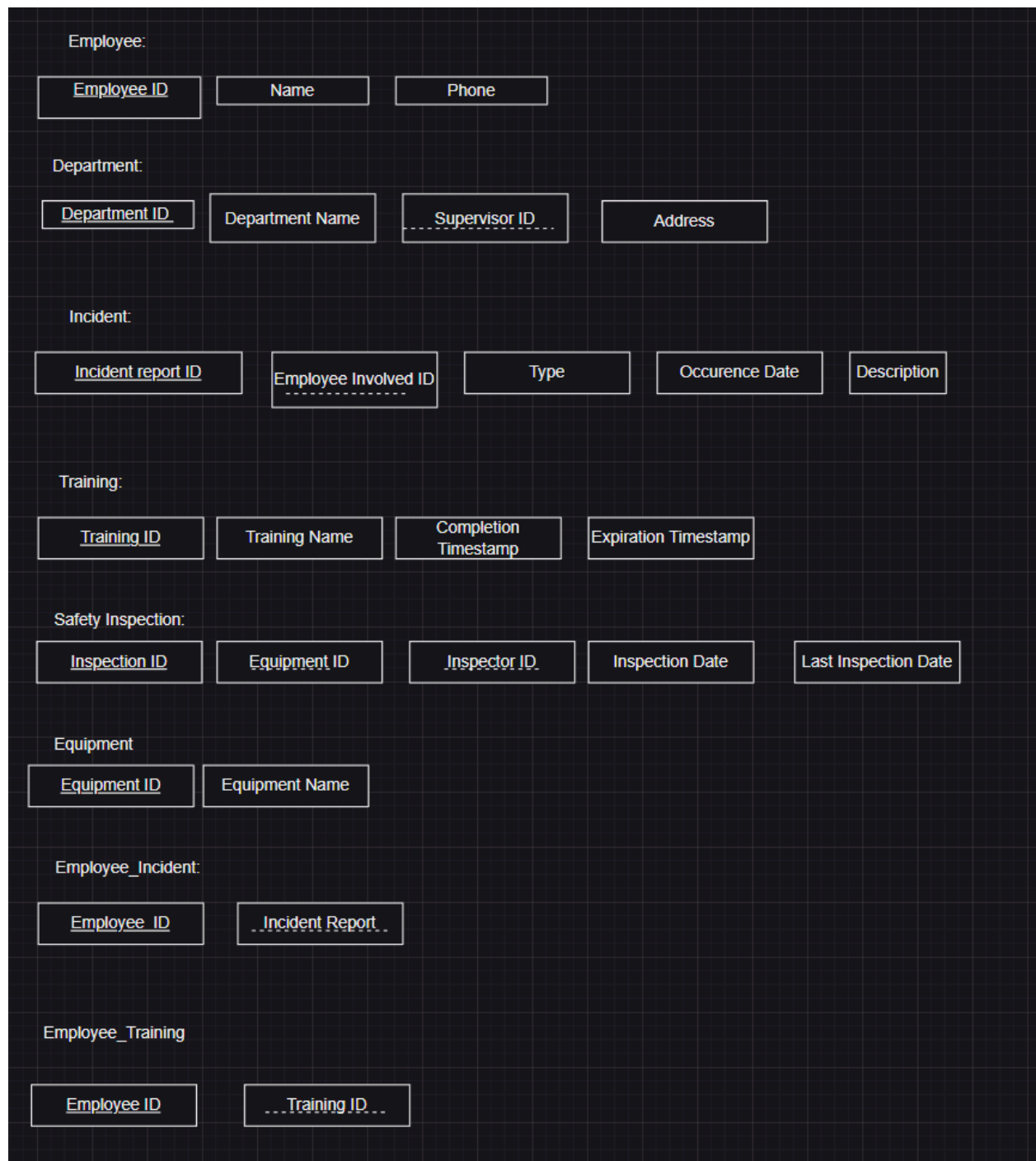
- Equipment has the following attributes: Equipment_ID, Equipment_Name, Last_Inspected_Date. Inspectors can inspect multiple pieces of equipment. A piece of equipment can be inspected multiple times over time.

EER Model



Project Deliverable 3:

Relations:



SQL:

```
CREATE TABLE Department (  
    Department_ID INT PRIMARY KEY,  
    Department_Name VARCHAR(255) NOT NULL  
);
```

```
CREATE TABLE Employee (  
    Employee_ID INT PRIMARY KEY,  
    Name VARCHAR(255) NOT NULL,  
    Address VARCHAR(255) NOT NULL,  
    City VARCHAR(255) NOT NULL,  
    State VARCHAR(255) NOT NULL,  
    Zip VARCHAR(10) NOT NULL,  
    Phone VARCHAR(15) NOT NULL,  
    Department_ID INT,  
    CONSTRAINT fk_employee_department  
        FOREIGN KEY (Department_ID) REFERENCES Department(Department_ID)  
);
```

```
CREATE TABLE Supervisor (  
    Supervisor_ID INT PRIMARY KEY,  
    Training_Certificate VARCHAR(255) NOT NULL,  
    CONSTRAINT fk_supervisor_employee  
        FOREIGN KEY (Supervisor_ID) REFERENCES Employee(Employee_ID)  
);
```

```
CREATE TABLE Equipment (  
    Equipment_ID INT PRIMARY KEY,  
    Equipment_Name VARCHAR(255) NOT NULL,  
    Last_Inspected_Date DATE NOT NULL  
);
```

```
CREATE TABLE Incident (  
    Incident_Report_ID INT PRIMARY KEY,  
    Employee_Involved_ID INT,  
    Type VARCHAR(255) NOT NULL,  
    Occurrence_Date DATE NOT NULL,  
    Description TEXT NOT NULL,  
    Severity VARCHAR(50) NOT NULL,  
    Supervisor_On_Duty_ID INT,  
    Root_Cause TEXT NOT NULL,  
    Impact VARCHAR(50) NOT NULL,  
    Equipment_Involved_ID INT,
```

```
CONSTRAINT fk_incident_employee
    FOREIGN KEY (Employee_Involved_ID) REFERENCES Employee(Employee_ID),
CONSTRAINT fk_incident_supervisor
    FOREIGN KEY (Supervisor_On_Duty_ID) REFERENCES Supervisor(Supervisor_ID),
CONSTRAINT fk_incident_equipment
    FOREIGN KEY (Equipment_Involved_ID) REFERENCES Equipment(Equipment_ID)
);
```

```
CREATE TABLE Safety_Inspection (
    Inspection_ID INT PRIMARY KEY,
    Inspector_ID INT,
    Equipment_ID INT,
    Inspection_Date DATE NOT NULL,
    CONSTRAINT fk_inspection_inspector
        FOREIGN KEY (Inspector_ID) REFERENCES Employee(Employee_ID),
    CONSTRAINT fk_inspection_equipment
        FOREIGN KEY (Equipment_ID) REFERENCES Equipment(Equipment_ID)
);
```

```
CREATE TABLE Employee_Training (
    Training_ID INT PRIMARY KEY,
    Supervisor_ID INT,
    Employee_ID INT,
    Training_Name VARCHAR(255) NOT NULL,
    Completion_Timestamp TIMESTAMP NOT NULL,
    Expiration_Timestamp TIMESTAMP NOT NULL,
    CONSTRAINT fk_training_supervisor
        FOREIGN KEY (Supervisor_ID) REFERENCES Supervisor(Supervisor_ID),
    CONSTRAINT fk_training_employee
        FOREIGN KEY (Employee_ID) REFERENCES Employee(Employee_ID)
);
```

```
INSERT INTO Department VALUES (1, 'EHS Department');
INSERT INTO Department VALUES (4, 'Quality Control Department');
INSERT INTO Department VALUES (5, 'Maintenance Department');
INSERT INTO Department VALUES (6, 'Shipping Department');
INSERT INTO Department VALUES (7, 'Security Department');
```

```
INSERT INTO Employee VALUES (1, 'John Doe', '123 Main St', 'City', 'State', '12345',
'123-456-7890', 1);
INSERT INTO Employee VALUES (4, 'Michael Williams', '890 Maple St', 'Village', 'State',
'78901', '111-222-3333', 4);
INSERT INTO Employee VALUES (5, 'Emily Davis', '123 Elm St', 'City', 'State', '56789',
'444-555-6666', 5);
```



```

INSERT INTO Employee VALUES (6, 'Alex Turner', '456 Pine St', 'Town', 'State', '34567',
'777-888-9999', 6);
INSERT INTO Employee VALUES (7, 'Sophia Rodriguez', '789 Oak St', 'City', 'State', '45678',
'333-444-5555', 7);

INSERT INTO Supervisor VALUES (1, 'Safety Certification');
INSERT INTO Supervisor VALUES (4, 'Quality Certification');
INSERT INTO Supervisor VALUES (5, 'Maintenance Certification');
INSERT INTO Supervisor VALUES (6, 'Shipping Certification');
INSERT INTO Supervisor VALUES (7, 'Security Certification');

INSERT INTO Equipment VALUES (1, 'Forklift', '2022-12-01');
INSERT INTO Equipment VALUES (4, 'Warehouse Crane', '2023-03-01');
INSERT INTO Equipment VALUES (5, 'Fire Extinguisher', '2023-04-01');
INSERT INTO Equipment VALUES (6, 'Delivery Truck', '2023-05-01');
INSERT INTO Equipment VALUES (7, 'Surveillance Cameras', '2023-06-01');

INSERT INTO Incident VALUES (15, 1, 'Accident', '2023-01-01', 'Description of the incident',
'High', 1, 'Root cause', 'Severe', 1);
INSERT INTO Incident VALUES (9, 4, 'Injury', '2023-03-15', 'Employee injury during work',
'High', 4, 'Equipment malfunction', 'Severe', 4);
INSERT INTO Incident VALUES (10, 5, 'Environmental', '2023-04-10', 'Minor environmental
damage', 'Low', 5, 'Human error', 'Minor', 3);
INSERT INTO Incident VALUES (11, 6, 'Safety Violation', '2023-05-20', 'Unsafe behavior',
'Medium', 6, 'Employee negligence', 'Moderate', 4);
INSERT INTO Incident VALUES (12, 7, 'Theft', '2023-06-05', 'Stolen property', 'Low', 7, 'Security
breach', 'Minor', NULL);

INSERT INTO Safety_Inspection VALUES (8, 1, 1, '2023-02-01');
INSERT INTO Safety_Inspection VALUES (9, 4, 4, '2023-04-15');
INSERT INTO Safety_Inspection VALUES (10, 5, 5, '2023-05-01');
INSERT INTO Safety_Inspection VALUES (11, 6, 6, '2023-06-15');
INSERT INTO Safety_Inspection VALUES (12, 7, 7, '2023-07-01');

INSERT INTO Employee_Training VALUES (8, 1, 1, 'Fall Protection', '2023-03-01',
'2023-06-01');
INSERT INTO Employee_Training VALUES (9, 4, 4, 'Quality Control', '2023-06-01',
'2023-09-01');
INSERT INTO Employee_Training VALUES (10, 5, 5, 'Facility Maintenance', '2023-07-01',
'2023-10-01');
INSERT INTO Employee_Training VALUES (11, 6, 6, 'Shipping Procedures', '2023-08-01',
'2023-11-01');
INSERT INTO Employee_Training VALUES (12, 7, 7, 'Security Assessment', '2023-09-01',
'2023-12-01');

```

desc department

	Field	Type	Null	Key	Default	Extra
▶	Department_ID	int	NO	PRI	NULL	
	Department_Name	varchar(255)	NO		NULL	

```
SELECT * FROM department
```

	Department_ID	Department_Name
▶	1	EHS Department
	4	Quality Control Department
	5	Maintenance Department
	6	Shipping Department
	7	Security Department
✱	NULL	NULL

desc Employee

	Field	Type	Null	Key	Default	Extra
▶	Employee_ID	int	NO	PRI	NULL	
	Name	varchar(255)	NO		NULL	
	Address	varchar(255)	NO		NULL	
	City	varchar(255)	NO		NULL	
	State	varchar(255)	NO		NULL	
	Zip	varchar(10)	NO		NULL	
	Phone	varchar(15)	NO		NULL	
	Department_ID	int	YES	MUL	NULL	

```
SELECT * FROM Employee
```

[illegible]

desc Supervisor

	Field	Type	Null	Key	Default	Extra
▶	Supervisor_ID	int	NO	PRI	NULL	
	Training_Certificate	varchar(255)	NO		NULL	

SELECT * FROM Supervisor

	Supervisor_ID	Training_Certificate
▶	1	Safety Certification
	4	Quality Certification
	5	Maintenance Certification
	6	Shipping Certification
	7	Security Certification
*	NULL	NULL

desc Equipment

	Field	Type	Null	Key	Default	Extra
▶	Equipment_ID	int	NO	PRI	NULL	
	Equipment_Name	varchar(255)	NO		NULL	
	Last_Inspected_Date	date	NO		NULL	

SELECT * FROM Equipment

	Equipment_ID	Equipment_Name	Last_Inspected_Date
▶	1	Forklift	2022-12-01
	4	Warehouse Crane	2023-03-01
	5	Fire Extinguisher	2023-04-01
	6	Delivery Truck	2023-05-01
	7	Surveillance Cameras	2023-06-01
*	NULL	NULL	NULL

desc Incident

	Field	Type	Null	Key	Default	Extra
►	Incident_Report_ID	int	NO	PRI	NULL	
	Employee_Involved_ID	int	YES	MUL	NULL	
	Type	varchar(255)	NO		NULL	
	Occurrence_Date	date	NO		NULL	
	Description	text	NO		NULL	
	Severity	varchar(50)	NO		NULL	
	Supervisor_On_Duty_ID	int	YES	MUL	NULL	
	Root_Cause	text	NO		NULL	
	Impact	varchar(50)	NO		NULL	
	Equipment_Involved_ID	int	YES	MUL	NULL	

SELECT * FROM Incident

	Incident_Report_ID	Employee_Involved_ID	Type	Occurrence_Date	Description	Severity	Supervisor_On_Duty_ID	Root_Cause	Impact	Equipment_Involved_ID
►	9	4	Injury	2023-03-15	Employee injury during work	High	4	Equipment malfunction	Severe	4
	10	5	Environmental	2023-04-10	Minor environmental damage	Low	5	Human error	Minor	1
	11	6	Safety Violation	2023-05-20	Unsafe behavior	Medium	6	Employee negligence	Moderate	4
	12	7	Theft	2023-06-05	Stolen property	Low	7	Security breach	Minor	NULL
	15	1	Accident	2023-01-01	Forklift Crash in to rack	High	1	Human Error	Severe	6
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

desc Safety_Inspection

	Field	Type	Null	Key	Default	Extra
►	Inspection_ID	int	NO	PRI	NULL	
	Inspector_ID	int	YES	MUL	NULL	
	Equipment_ID	int	YES	MUL	NULL	
	Inspection_Date	date	NO		NULL	

SELECT * FROM Safety_Inspection

	Inspection_ID	Inspector_ID	Equipment_ID	Inspection_Date
►	1	1	1	2023-02-01
	8	1	1	2023-02-01
	9	4	4	2023-04-15
	10	5	5	2023-05-01
	11	6	6	2023-06-15
	12	7	7	2023-07-01
▲	NULL	NULL	NULL	NULL

desc Employee_Training

	Field	Type	Null	Key	Default	Extra
►	Training_ID	int	NO	PRI	NULL	
	Supervisor_ID	int	YES	MUL	NULL	
	Employee_ID	int	YES	MUL	NULL	
	Training_Name	varchar(255)	NO		NULL	
	Completion_Timestamp	timestamp	NO		NULL	
	Expiration_Timestamp	timestamp	NO		NULL	

SELECT * FROM Employee_Training

	Training_ID	Supervisor_ID	Employee_ID	Training_Name	Completion_Timestamp	Expiration_Timestamp
►	8	1	1	Fall Protection	2023-03-01 00:00:00	2023-06-01 00:00:00
	9	4	4	Quality Control	2023-06-01 00:00:00	2023-09-01 00:00:00
	10	5	5	Facility Maintenance	2023-07-01 00:00:00	2023-10-01 00:00:00
	11	6	6	Shipping Procedures	2023-08-01 00:00:00	2023-11-01 00:00:00
	12	7	7	Security Assessment	2023-09-01 00:00:00	2023-12-01 00:00:00
*	NULL	NULL	NULL	NULL	NULL	NULL

5 QUERIES:

Selecting all employees with their department names:

```
SELECT Employee.Employee_ID, Employee.Name, Employee.Address, Employee.City, Employee.State, Employee.Zip, Employee.Phone, Department.Department_Name
FROM Employee
JOIN Department ON Employee.Department_ID = Department.Department_ID;
```

	Employee_ID	Name	Address	City	State	Zip	Phone	Department_Name
▶	1	John Doe	123 Main St	City	State	12345	123-456-7890	EHS Department
	4	Michael Williams	890 Maple St	Village	State	78901	111-222-3333	Quality Control Department
	5	Emily Davis	123 Elm St	City	State	56789	444-555-6666	Maintenance Department
	6	Alex Turner	456 Pine St	Town	State	34567	777-888-9999	Shipping Department
	7	Sophia Rodriguez	789 Oak St	City	State	45678	333-444-5555	Security Department

Counting the number of incidents for each severity level:

```
SELECT Severity, COUNT(*) AS Incident_Count
FROM Incident
GROUP BY Severity;
```

	Severity	Incident_Count
▶	High	2
	Low	2
	Medium	1

Finding the average days since last inspection for equipment:

```
SELECT AVG(DATEDIFF(NOW(), Last_Inspected_Date)) AS Average_Days_Since_Inspection
FROM Equipment;
```

	Average_Days_Since_Inspection
▶	254.2000

Displaying employee training details along with supervisor names:

```
SELECT Employee_Training.Training_ID, Employee.Name AS Employee_Name, Supervisor.Training_Certificate,  
Employee_Training.Training_Name, Employee_Training.Completion_Timestamp, Employee_Training.Expiration_Timestamp  
FROM Employee_Training  
JOIN Employee ON Employee_Training.Employee_ID = Employee.Employee_ID  
JOIN Supervisor ON Employee_Training.Supervisor_ID = Supervisor.Supervisor_ID;
```

	Training_ID	Employee_Name	Training_Certificate	Training_Name	Completion_Timestamp	Expiration_Timestamp
►	8	John Doe	Safety Certification	Fall Protection	2023-03-01 00:00:00	2023-06-01 00:00:00
	9	Michael Williams	Quality Certification	Quality Control	2023-06-01 00:00:00	2023-09-01 00:00:00
	10	Emily Davis	Maintenance Certification	Facility Maintenance	2023-07-01 00:00:00	2023-10-01 00:00:00
	11	Alex Turner	Shipping Certification	Shipping Procedures	2023-08-01 00:00:00	2023-11-01 00:00:00
	12	Sophia Rodriguez	Security Certification	Security Assessment	2023-09-01 00:00:00	2023-12-01 00:00:00

Summing up the number of safety inspections conducted by each inspector:

```
SELECT Inspector_ID, COUNT(*) AS Inspection_Count  
FROM Safety_Inspection  
GROUP BY Inspector_ID;
```

	Inspector_ID	Inspection_Count
►	1	1
	4	1
	5	1
	6	1
	7	1