

# NOC:HSE for offshore and petroleum engineers- Practices - Video course

## COURSE OUTLINE

The course will give an overview of the safety and environmental issues in the petroleum industry. It will provide detailed understanding of the methods and techniques to resolve these key issues for making petroleum production and processing, cleaner and safer. This course would educate the participants to identify and assess hazards in any stage of operation, to quantify and manage them as well. This course will also highlight lessons learnt from the past accidents.

## COURSE DETAIL

Week .No	Topic
1	<b>Environmental issues and management</b> Environmental impact and management Impact of oil and gas industry in marine environment Oil hydrocarbons in marine environment Chemical disposal of offshore industry and environmental management Dispersion models and atmospheric pollution Dispersion models continued.. Hazard assessment
2	<b>Operational Safety</b> Introduction to HSE Safety assurance Safety in design and operations Organizing for safety Hazard classification and assessment, Hazard evaluation and control Hazop FMEA
3	<b>Accident modeling, risk assessment &amp; management</b> Dose assessment, safety regulations Toxic releases- models and methods Chemical risk analysis Quantitative risk assessment Fire and explosion models Flammability diagrams Fire and explosion: prevention methods Event tree and fault tree analyses Process safety management Software used in HSE



NP-TEL

NPTEL

<http://nptel.ac.in>

## Ocean Engineering

### Pre-requisites:

UG/PG/Ph.D of all engg branches and PG of applied sciences;  
Diploma students can also register

### Additional Reading:

1. Ale B. J. M. 2002. Risk assessment practices in The Netherlands Safety Science, 40, 105-126.
2. Amendola A., S. Continin, I. Ziomas. 1992. Uncertainties in chemical risk assessments: Results of a European benchmark exercise, Journal of Hazardous Materials, 29, 347-363.
3. Arshad Ayub. 2011. *Hazard identification and management in oil and gas industries*, M.Tech (Petroleum Engg) dissertation submitted to IIT Madras.
4. Bhattacharyya, S.K., Srinivasan Chandrasekaran, Ram Prasad. 2010a. Event analysis for offshore riser failure. Proc. 1st International Conf. on Drilling Technology (ICDT 2010), IIT Madras, India, 18-20th Nov 2010.
5. Bhattacharyya, S.K., Srinivasan Chandrasekaran, Ram Prasad. 2010b. Risk assessment for offshore pipelines, Proc. 1st International Conf. on Drilling Technology (ICDT 2010), IIT Madras, India, 18-20th Nov 2010.
6. Bonvicini S., P. Leonelli, G. Spadoni. 1998. Risk analysis of hazardous materials transportation: evaluating uncertainty by means of fuzzy logic, Journal of Hazardous Materials, 62, 59-74. [doi:10.1016/S0304-3894\(98\)00158-7](https://doi.org/10.1016/S0304-3894(98)00158-7).
7. Bottelberghs P. H. (2000) Risk analysis and safety policy developments in the Netherlands, journal of Hazardous Materials, 71, 59-84. [doi:10.1016/S0304-3894\(99\)00072-2](https://doi.org/10.1016/S0304-3894(99)00072-2).
8. Brazier A. M. and R. L. Greenwood (1998) Geographic information systems: a consistent approach to land use planning decisions around hazardous installations, Journal of

Hazardous Materials, 61, 355-361.

9. Brode, H. L., (1959) Blast Wave from a Spherical Charge, The Physics of Fluids, 2(2), 217  
–229. doi: [10.1063/1.1705911](https://doi.org/10.1063/1.1705911).

10. Chamberlain, G.A. (1987). Development in design methods for predicting thermal radiation from flares. Chemical Engineering Research and Design, Vol. 65, pp. 299 - 309. ISSN 0263-8762. doi: 10.2478/v10281-012-0006-9.

11. Che Hassan, C.R., B. Puvaneswaran, A.R. Aziz, M. Noor Zalina, F.C. Hung, N.M. Sulaiman (2009) A case study of Consequences Analysis of Ammonia Transportation by Rail from Gurun to Port Klang in Malaysia using Safety Computer Model, Journal of SH & E Research Vol.6, No.1, Spring.

12. Che Hassan, C.R., B. Puvaneswaran, A.R. Aziz, M. Noor Zalina, F.C. Hung, N.M. Sulaiman (2010) Quantitative Risk Assessment for the Transport of Ammonia by Rail, American Institute of Chemical Engineers Process Safety Progress, 29, 60-63. doi:10.1002/Prs.10345.

13. Chuan-Jie Zhu, Bai-quan Lin, Bing-you Jiang, Qian Liu, Yi-du Hong (2013) Numerical Simulation of blast wave oscillation effects on a premixed methane/air explosions in closed end ducts, Journal of Loss Prevention in the Process Industries, 26, 851-861.

14. Crawley, F., M. Preston, and B. Tyler: "HAZOP: Guide to best practice. Guidelines to best practice for the process and chemical industries". European Process Safety Centre and Institution of Chemical Engineers, 2000

15. David Brown, F. and E. William Dunn (2007) Application of a quantitative risk assessment method to emergency response planning, Computers & Operations Research, 34, 1243-1265.

16. David W. Johnson and John B. Cornwell (2007) Modeling the release, spreading and burning of LNG, LPG and gasoline on water, Journal of Hazardous Materials, Vol 140:3, 535-540. doi: 0.1016/j.jhazmat.2006.10.022.

17. DNV Phast Risk, Det Norske Veritas, 2005, User manual- Version 6.7.

18. Dziubinski M., M. Fraczkak, A. S. Markowski (2006) Aspects of risk analysis associated with major failures of fuel pipelines, Journal of Loss Prevention in the Process Industries, 19, 399-400.  
doi: [10.1016/j.jlp.2005.10.007](https://doi.org/10.1016/j.jlp.2005.10.007).

19. Efthimia K. Mihailidou, Konstantinos D. Antomiadis, Marc J. Assael (2012) The 319 Major Industrial Accidents Since 1917, International Review of Chemical Engineering, Vol. 4:6, 1755-2035.

20. Engelhard, W. F. J. M., de Klepper, D.W. Hartmann (1994) Hazard Analysis for the Amoco Netherlands P1S-P1S Production Facilities in the North Sea, Proceedings of SPE

International Conference on Health, Safety and Environment, Jakarta, January.

21. Erik Vanem, Pedro Antao, Ivan stivik, Francisco Del Castillo de Comas (2008) Analyzing the risk of LNG carrier operations, *Reliability Engineering and System safety*, 93, 1328-1344.  
doi:10.1016/j.ress.2007.07.007.

22. Frank, K.H. and Morgan, H.W. 1979. A logical risk process of risk analysis, *Professional Safety*, June, 23-30.

23. Henselwood F. and G. Phillips (2006) A matrix based risk assessment approach for addressing linear hazards such as pipelines, *Journal of Loss Prevention in the Process Industries*, 19, 433-441

24. IEC 61882. "Hazard and operability studies (HAZOP studies)—Application guide". International Electro technical Commission, Geneva.

25. IS1656:2006, Indian Standard Hazard Identification and Risk Analysis-Code of Practice, Bureau of Indian Standards, 2006

26. Jan Erik Vinnem. 2007. *Offshore Risk Assessment: Principles, Modeling and Applications of QRA studies*. Springer, 577pp.

27. Khan, F.I. and Abbasi, S.A. 1999. Major accidents in process industries and analysis of causes and consequences, *J. Loss Prevention in Process Industries*, 12(5), pp. 361-378.

28. Kiran, A. 2014. *Accident modeling and risk assessment of oil and gas industries*, M.S (by research) thesis submitted to IIT Madras.

29. Kiran. 2012. *Risk analyses of offshore drilling rigs*, M.Tech (Petroleum Engg) dissertation submitted to IIT Madras.

30. Kyriakdis, I.: "HAZOP - Comprehensive Guide to HAZOP in CSIRO", CSIRO Minerals, National Safety Council of Australia, 2003

31. Lees, F.P. 1996. *Loss Prevention in Process Industries: Hazard identification, Assessment and Control*, Vol. 1-3, Butterworth-Heinemann, Oxford, 1245pp.

32. Leonelli P., S. Bonvicini, G. Spadoni (1999) New detailed numerical procedures for calculating risk measures in hazardous material transportation, *Journal of Loss Prevention in the Process Industries*, 12, 507-515. doi:10.1016/S0950-4230(99)00023-6.

33. Marco Pontiggia, Gabriele Landucci, Valentina Busini, Marco Derudi, Mario Alba, Marco Scaioni, Sarah Bonvicini, Valerio Cozzani, Renato Rota (2011) CFD model simulation of LPG dispersion in urban areas, *Atmospheric Environment*, Vol. 45:24, 3913-3923.  
doi:10.1016/j.atmosenv.2011.04.071.

34. Mercedes Gomez-Mares, Luis Zarate, Joaquim Casal (2008) Jet fires and the domino effect, *Fire Safety Journal*, 43, 583-588.

doi:10.1016/j.firesaf.2008.01.002.

35.Nivolianitou, Z., Konstandinidou, M., and Michalis, C. 2006. Statistical analysis of major accidents in petrochemical industry notified to the major accident reporting system (MARS), *J. Hazardous Materials*, 136(1), pp. 1-7.

36. OGP Risk Assessment Data Directory: Report No.434-1, Process Release Frequencies, March 2010.

37. OISD - GDN - 169, OISD Guidelines on Small LPG bottling plants (Design and Fire Protection Facilities), Oil Industry Safety Directorate, Amended edition, 2011.

38. OISD Standard - 116, Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants, Oil Industry Safety Directorate, Amended edition, 2002

39. OISD Standard - 144, Liquefied Petroleum Gas (LPG) Installations, Oil Industry Safety Directorate, Second edition, 2005.

40. OISD Standard - 150, Design and Safety Requirements for Liquefied Petroleum Gas Mounded Storage Facility, Oil Industry Safety Directorate, 2013.

41. Papazoglou I. A., L. J. Bellamy, Aneziris O. N., Ale B. J. M., Post J. G., Oh J. I. H. (2003) I-risk: development of an integrated technical and management risk methodology for chemical installations, *Journal of Loss Prevention in the Process Industries*, 16, 575-591.

doi:10.1016/j.jlp.2003.08.008

42. Pasman H.J., S. Jung, K. Prem, W. J. Rogers, X. Yang (2009), Is risk analysis a useful tool for improving process safety, *Journal of Loss Prevention in the Process Industries*, 22, 769-777.

doi:10.1016/j.jlp.2009.08.001.

43. Patin Stanislav. 1999. *Environmental Impact of the Offshore Oil and Gas Industry*. Eco Monitor Publishing, USA, 425pp.

44. Planas-Cuchi E., J. M. Salla, J. Casal (2004) Calculating overpressure from BLEVE explosions, *Journal of Loss Prevention in the Process Industries*, 17, 431-436. doi:10.1016/j.jlp.2004.08.002.

45. Prem, K.P., Ng, D. and Mannan, M.S. 2010. Harnessing database resources for understanding profile of chemical process industry incidents, *J. Loss Prevention in Process Industries*, 23(4), pp. 549-560.

46. Ramamurthy, K. 2011. *Explosions and explosion safety*, Tata McGraw Hill, New Delhi, INDIA, pp. 288.

47. Roberto Bubbico and Mauro Marchini (2008) Assessment of an explosive LPG release accident: A case study, *Journal of Hazardous Materials*, Vol 155:3, 558-565. doi:10.1016/j.jhazmat.2007.11.097.

48. Skelton, B. 1997. *Process safety analysis*, Gulf Publishing Company, Houston, 210pp.

49. Srinivasan Chandrasekaran 2011d. Strategic Rig Project Commissioning

and Risk Management, Keynote address at Post Conf. Workshop on Intl. Conf on Offshore Drilling Rigs, IBC Asia, Singapore, 24-29th July 2011.

50.Srinivasan Chandrasekaran 2015. HSE in offshore and petroleum engineering, Lecture notes of online web course, Mass Open-source Online Courses (MOOC), National Program on Technology Enhancement and Learning (NPTEL), Govt. of India.

51.Srinivasan Chandrasekaran and Harinder. 2011. Design and efficiency analysis of Mechanical Wave Energy converter. Proc. 30th International Conf. on Ocean, Offshore and Arctic Engg, OMAE 2011, Rotterdam, The Netherlands, 19-24th June, 2011, OMAE 2011-49830.

52.Srinivasan Chandrasekaran and Harinder. 2014.Failure mode and effects analysis of Mechanical wave energy converters, Intl J of Intelligent Engineering informatics (in press)

53.Srinivasan Chandrasekaran and Kiran A. 2014a. Accident Modeling & Risk Assessment of Oil & Gas Industries, Proceedings of 9th Structural Engineering Convention (SEC 2014), IIT Delhi, India. December 22-24, 2014.

54.Srinivasan Chandrasekaran and Kiran A. 2014b. Consequence Analysis and risk assessment of oil and gas industries, Proc. International Conference on Safety & Reliability of Ship, Offshore and subsea structures, Glasgow, UK, Aug 18-20, 2014.

55.Srinivasan Chandrasekaran and Kiran, A. 2015. Quantified risk assessment of LPG filling station, *Professional Safety*, J. of American Soc. of Safety Engineers (ASSE), Sep 2015.

56.Srinivasan Chandrasekaran, Ramesh Babu, Arshad Ayub. 2010. Hazop study for crude oil pipe line. Proc. 1st International Conf. on Drilling Technology (ICDT 2010), IIT Madras, India, 18-20th Nov 2010.

57.Srinivasan Chandrasekaran. 2010a. Chemical Risks- an Overview. Key note address at HSE in Oil and gas- exploration and production, International HSE Meet, IBC-Asia, Kuala Lumpur, Malaysia, Dec 6-8th , 2010.

58.Srinivasan Chandrasekaran. 2010b. Risk assessment of offshore pipelines. Key note address at HSE in Oil and gas- exploration and production, International HSE Meet, IBC-Asia, Kuala Lumpur, Malaysia, Dec 6-8th , 2010.

59.Srinivasan Chandrasekaran. 2011a. Hazard identification and Management in oil and gas industry using Hazop. Proc. of seminar on Human Resource Development for Offshore and Plant Engineering (HOPE), Changwon University, South Korea, April 2011, pp. 1-10.

60.Srinivasan Chandrasekaran. 2011b. Health, Safety and Environmental Management in petroleum and offshore engineering.

Proc. of seminar on Human Resource Development for Offshore and Plant Engineering (HOPE), Changwon University, South Korea, April 2011, pp. 23-28.

61.Srinivasan Chandrasekaran. 2011c. Quantitative risk assessment of Group Gathering Station (GGS) of oil exploration and production. Proc. of seminar on Human Resource Development for Offshore and Plant Engineering (HOPE), Changwon University, South Korea, April 2011, pp. 11-22.

62.Srinivasan Chandrasekaran. 2011d. Risk Assessment and Management in offshore and petroleum industries, Key note address at Pre-conference workshop on International Conference on Asia Pacific HSE Forum on Oil, Gas and Petrochemicals, Fleming Gulf Conferences, 22-24th Sep 2011, Kuala Lumpur, Malaysia, pp. 81.

63.Srinivasan Chandrasekaran. 2014a. Health, Safety and Environmental Management (HSE), Key note address at National Research Foundation of Korea, HRD Team for Offshore Plant FEED Engineering, Changwon National University, South Korea, 25th Feb 2014.

64.Srinivasan Chandrasekaran. 2014b. Technological advancements in Process Safety Management, Key note address in the 4th Annual HSE Excellence Forum in oil, Gas and Petrochemicals, 19-21 Aug 2014, Kuala Lumpur, Malaysia

65.Srinivasan Chandrasekaran. 2015. Advanced Marine structures, CRC Press, Florida, ISBN 978-14-987-3968-9

66.Srinivasan Chandrasekaran. 2016a. Offshore structural engineering: Reliability and Risk Assessment. CRC Press, Florida, ISBN:978-14-987-6519-0

67.Srinivasan Chandrasekaran. 2016b. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, John Wiley & Sons, ISBN: 978-11-192-2184-5.

68.Tasneem Abbasi and S. A. Abbasi (2007) The boiling liquid expanding vapor explosion (BLEVE): Mechanism, consequence assessment and management, Journal of Hazardous Materials, 141, 489-519.  
doi:10.1016/j.jhazmat.2006.09.056.

69.Terje Aven and Jan Erik Vinnem. 2007.*Risk Management with applications from Offshore Petroleum Industry*. Springer, 200pp.

70.Thomas V. Rodante, 2004, Analysis of an LPG explosion and fire, Process Safety Progress. 22, 174-181.  
doi:10.1002/prs.680220307.

71.TNO (1999) Guidelines for quantitative risk analysis, The Director General of Labour, The Hague, Netherlands.

72.Trevor Kletz. 2003.*Still going*

wrong: *Case histories and plant disasters*, Elsevier, pp. 230.

73. Valerie J. Sutherland, Cary L. Cooper. 1991. *Stress and accidents in offshore, oil and gas industries*, Gulf Publishing Co., Houston, pp. 227.

74. Venkata Kiran, G. 2011. *QRA in oil & gas industries using PHAST RISK*, M.Tech (Petroleum Engg) dissertation submitted to IIT Madras.

75. Webber, D.M., S.J. Jones, G.A. Tickle, and T. Wren, (1992): A Model of a Dispersing Gas Cloud, and the Computer Implementation. I: Near Instantaneous Release, II: Steady Continuous Releases. UKAEA Reports SRD/HSE R586 (for part I) and R. 587 (for part II).

76. William J. Cairns (Ed), 1992. *North Sea Oil and the Environment: Development Oil and Gas Resources, Environmental Impacts and Responses*, International Council of Oil and the Environment.

77. Wiltox, H. W. M., (2001) Unified Dispersion Model (UDM), Theory Manual, DNV.

78. Zhang Qian-xi and Liang Dong (2013), Thermal radiation and Impact Assessment of the LNG BLEVE Fireball, *Procedia Engineering*, 52, 602-606. [doi:10.1016/j.proeng.2013.02.192](https://doi.org/10.1016/j.proeng.2013.02.192)

**Coordinators:**

**Dr. Srinivasan Chandrasekaran**  
Department of Ocean Engineering IIT  
Madras